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*Illustrated.

The Engineering and Mining Journal

MARCH 4, 1911.

The Railway Decision

The great event of the last week was the denial by the Interstate Commerce Commission of the railways' application for permission to raise rates. This matter is of vast importance to the mining industry, not only because of its dependence upon moderate freight rates, but also because the railways are among the largest buyers of metals.

If we accepted the statements of the angry presidents after the decision was rendered, we should have prepared ourselves for a complete cessation of buying of everything. In short, it seemed as if the railways were contemplating going out of business. However, we do not fear that, the Interstate Commerce Commission having pointed out in a masterly analysis that the net receipts of the railways in 1910 were greater than ever before; and we opine that they will continue to buy our iron, copper, etc.

We believe that sober thought will indicate that the decision was a good thing for the railways themselves. The plan of meeting the demands of labor by raising rates would result only in more demands by labor and the thing would have gone on in a vicious circle. The burden of increased freight rates would ultimately have rested upon the wage-earners. The economic necessity of the times is reduction in the cost of living, not increase thereof.

The railways are now in a position to resist further demands by their men, and they may, moreover, find it worth while to consider what economies may be effected, and even to reflect upon the possibilities of "scientific management," which up to date they have pretended to despise. Probably they will be led to improve their methods to such an extent as to establish their credit on a firmer basis than ever before. The decision is likely to prove a blessing in disguise. Anyway, the railway companies will surely continue to run their trains, maintain their tracks, and use up steel and copper just as if there had been no adverse decision.

The Arizona "Porphyries"

The Arizona Copper Company, mining a little upward of 2000 tons of ore per day and producing about 32,000,000 lb. of copper per year, made its output in 1910 at a cost of 10.3c. per lb. The methods of this company are in some respects antiquated, and some of its ore is rather difficult of treatment. The modern methods that are being introduced by the newer porphyry mines will undoubtedly result in great economy as compared with the cost at Clifton, the estimate of 9c. being in no way unreasonable. It is to be recollected, however, that of the new mines Miami is the only one possessing an ore whereof the yield per ton will be approximately that of Clifton. When the managers of the mines of 2 per cent. ore, which may be assumed to yield about 26 lb. of copper per ton, tell us that they are going to produce copper at 9c. per lb., well, "we're from Missouri."

Proposed Coal Combination

The project for a combination of coal operators to include all the districts in the central competitive States, as outlined by a correspondent, is an ambitious one, and undoubtedly has attractions for coal operators. As now proposed, it is to cover all the districts from western Pennsylvania to Oklahoma, and is to regulate competition, production and prices; incidentally, also, it is expected to promote improvement in mining methods. The promoters are enthusiastic over the movement; but they seem to have taken too little account of the many obstacles in the way.

Foremost among these, of course, are the Federal anti-trust laws and those of several of the States. Such a combination as is proposed would be directly in contravention of these statutes. Another important consideration is the divergent

interests of different districts, and the equally divergent interests of the larger and smaller operators in the several States. The combination as proposed covers so wide a territory that it would seem impossible to bring in all the operators; in any event it would be a long and uphill work. A still more difficult task would be to hold every operator to the agreement, should it be made. Nor is it certain that such a combination is desirable. It would certainly be one in restraint of trade; and one in which the interests of the consumers would be set aside more freely and openly than by some of those trusts and combinations which are exciting so much popular hostility.

The coal trade is certainly suffering at present from overproduction and excessive competition. Some means may be devised to reduce these evils; but the combination now proposed is hardly likely to be successful.

Improvements in Copper Smelting

Our copper smelters, having largely perfected the mechanical methods of handling material in and about their works, having increased the size of their furnaces to what now seems to be the economic maximum, and having to a large extent solved the problem of handling fine ore to advantage, are again turning their attention to more purely metallurgical improvements. Some noteworthy advances in this respect have lately been made, the most far-reaching of these having been undoubtedly the successful introduction of the basic-lined converter, which has already become an extensively-used feature of modern practice.

An interesting innovation that is shortly to be tried on a large scale is the blowing of high-grade, fine concentrates into the converter, a special tuyere for this purpose having lately been invented. By this device, which is held in high estimation by metallurgists who have witnessed its operation, a careful adjustment of the feed into the converter is accomplished. This method is to be employed at Cananea for the treatment of the Miami concentrate, and we understand it is also to come into use elsewhere.

If this method proves advantageous, the successful introduction of the basic-lined converter being, of course, the factor that renders it possible, copper metallurgy will have made a long stride toward real pyritic smelting, and the treatment of excessively fine ore will have ceased to be the bugbear that once it was.

Light Railways

It is reported that the Nigerian tinfields, from which it is expected that the present deficiency in the world's tin supply is largely to be made good, are to be opened by a railway of 2½-ft. gage, about 100 miles in length. This is interesting as another example of the employment of light railways in the development of the resources of the Dark Continent. The most noteworthy of such lines is the one that was built in German Southwest Africa to bring out the product of the Otavi mines. This remarkable line is about 350 miles long, of 600-mm., or about 24-in. gage.

In this country, in the early days of the region west of the Rocky mountains, many narrow-gage railways, so called, were constructed to mining camps, but these were of 3-ft. gage, which is a big affair compared with the real light railways. Of the latter we have had but few examples. Indeed, the only ones that we recall are that of the Arizona Copper Company, from Morenci to Clifton, about 11 miles of 24-in. gage, and that in Mexico which connects the Palmarejo mines with their mill, this being 12½ miles of 30-in. gage. On the latter line a 22-ton locomotive handled 14 cars, carrying 63 tons of ore, making the round trip in 4 to 4½ hours.

The advantages of light railways depend, of course, upon their low cost of construction. Not only is the track material per mile of relatively small cost, but also they can be laid out upon comparatively steep gradients and very small radii of curvature, while bridges are, of course, of much more moderate cost than for broader gages. We are inclined to think that in many cases large sums of money are expended in the construction of railways of standard-gage where a light railway or a ropeway would fulfil the real needs at a much less cost; also that these comparatively inexpensive means of transportation have not been given sufficiently careful consideration in connection with mineral resources at present lying unworked.

We wonder if the awakening of China in the development of her mineral resources has been fully recognized. In fact, Chinese pig iron is now a regular commodity on our own Pacific coast, while on our Atlantic coast we receive liberal supplies of Chinese tin and Chinese antimony. In both the tin and antimony markets of the world, China is now an important factor. European smelters derive some lead and zinc ore from China, and what more there is to come thence who can tell? Let us hope that the Chinese do not take it into their heads to discover and exploit copper mines. Rather let us pray that they will inaugurate a new coinage, such as gave the market a fillip in 1905.

The announcement in the Johannesburg letter in last week's JOURNAL of the discovery of a gold-bearing reef on the Cyferfontein farm, near Klerksdorp, is of much interest, although up to the present it has not been established whether it is a part of the Main Reef series or of a separate series. The reef was encountered at a depth of 560 ft., and 12 in. of it were reported to assay 39.5 dwt. The borehole is being continued and is reported to have intersected another reef but no disclosure has been made as to its metal content.

About 60 miles southwest of Randfontein the lower division of the Witwatersrand formation is regarded as coming to the surface, and the older geologists consider the quartzite in which the new reef has been found to be below the Main Reef series. The discovery may be fraught with large possibilities for the southwestern Rand, but further investigation must be made before its value can be judged.

The last issue of the JOURNAL, that of Feb. 25, may be taken as an example of how the proposals of the Postoffice Department would work. This issue comprised the usual 48 pp. of reading and along with it carried 84 pp. of advertising. The weight of a single copy was 13.615 oz. The weight of the advertising pages alone was 8.854 oz. The subscription price is 9.6c. per copy. Under the present second-class mail rate the postage per copy is 0.85c. The Postoffice Department would raise this to 2½c. per copy.

Metallics

In sampling metal bars by drilling, the use of taper-shank drills is a great money saver.

For a given tank and mother liquor, slower crystallization can be brought about by carefully running in a thin layer of water on top of the liquor.

Small quantities of flue dust have been successfully smelted by moistening and wrapping in heavy paper bags and placing the bags carefully on the charge. The method, however, needs a cool top on the furnace and low blast.

The Eureka Windfall Mining Company, of Eureka, Nev., is said to be doing the cheapest cyaniding of any concern in the world. It is said that the total cost of crushing and cyaniding, including all operations from the time the ore leaves the mines, was only 80.4c. per ton on the first 30,000 tons of ore milled.

If, in melting retort metal, a flux is used composed of two parts sodium bicarbonate, two parts potassium carbonate and one part borax glass, a slag is obtained that is gradually decomposed by moisture. The greater part of the slag is soluble in water after decomposition. Using such a flux, the amount of slag to be remelted can be reduced to an amount not inconveniently too great to add to a later melting.

In the tropics galvanized iron soon corrodes and the use of the "cement" paint is especially recommended in such climates. An excellent paint of this type is made as follows: Red lead, 25 lb.; white lead ground in oil, 25 lb.; sifted portland cement, 10 lb.; boiled linseed oil, 7 gal. Mix the lead with the oil, then sift in the cement while stirring, and add 1 gill of japan drier for each gallon of paint. The paint is applied thickly with a brush; the mixture should be stirred frequently while applying. This paint protects the iron much better and for a longer time than paints in which there is no cement.

In precipitating copper by aluminum in the analysis of ores and mattes, aluminum foil is generally used. The manipulations are greatly facilitated by using aluminum wire. A piece of No. 14 wire, about 18 in. long, is closely coiled for all but five or six inches of its length, around a lead pencil; the coil is then opened slightly. The precipitation is effected by the coiled part, the straight wire being used as a handle. If the precipitation is done in a flare-neck "copper" flask, and the solution boiled until all the iron is reduced (until the solution is colorless) the copper precipitate will fall almost completely from the aluminum to the bottom of the flask, where it may be gathered in a heap and the bulk of the solution be decanted without any of the copper passing out.

By the Way

James MacNaughton, general manager of the Calumet & Hecla, in arguing against the proposed tonnage tax of ½c. per lb. on copper produced in Michigan, said that "In 10 years the mines of the Upper Peninsula will be producing only 16 lb. of copper to the ton of ore." Mr. MacNaughton said further that out of the total copper production of Michigan 55,000,000 lb. are produced annually at a loss. This is about 25 per cent. of the production.

The method for the direct determination of hydrogen, given elsewhere in the JOURNAL, is of interest alike to the analyst and to the pure chemist. To the former it means freedom from the troubles connected with the explosion pipette, and the calculations and manipulations involved in the introduction of air or oxygen. To the latter it is noteworthy, as it marks another step in direct elemental determination, while it makes use of the properties of what was long regarded as a chemical curiosity without utility, a colloidal metal. Which again proves that the ultimate results of any discovery are not to be foreseen.

In the copper trade it has been a "buyers' market" for a long time. They catch the producers both going and coming. The buyers said, "We need not contract ahead for copper because you producers are turning out so much that you have always got a surplus that you are anxious to sell." Then the producers curtail their output, the surplus diminishes, but buyers don't get scared. Some doubts are expressed as to whether there was really a curtailment, so producers publish statistics to show how much they have really cut themselves down. This ought to be a bullish argument, but the perverse consumers say "See! That shows how much the production can be quickly increased if we bid up the price! We won't do it." However, the producers will not, perhaps, be so easy to swell their output as the consumers think. Some of them have learned a lesson about the folly of sacrificing their resources. We are inclined to think that attention now should be focused on the growth of consumption rather than upon the matter of production.

A reported discovery of osmium ore was recently chronicled by a contemporary under the heading of "Armor Plate Ore." We find further, "the ore is a hard, infusible, bluish metal, and is the heaviest substance known. It has a value of $40 per ounce and is extensively used in the manufacture of armor plate and in the construction of steel battleships." Further we find osmium steel credited with tensile strength of 71,000 lb. per sq. in., concerning which we read, "this is due to the wonderful resistance of the osmium, contained in the ore, and infusing it with common iron there is nickel enough in it to make a metal of the osmi-radium group that will stand any amount of heat or pressure. The metals can be extracted by the electrochemical process, and can be smelted direct by electricity and the fine metal produced in a condition ready for forging or resmelting, and can then be recast into ingots or rolled into sheets or rods." The deposit lies five miles northeast of Boisè Ida., and a million-dollar corporation already controls it. This is, indeed, important if true.

Having only recently chronicled the close of another chapter of the perennial dip-needle swindle, we are now confronted with its first cousin, the human dip needle. An engineer in the Lake Superior iron country sends an account of this old acquaintance. A Minneapolis paper of Feb. 5, says: "Down in Bayfield county, Wisconsin, there is a man who is so strongly charged with magnetism that he is going to be used next spring and summer, as soon as the snow goes off, to locate deposits of rich ore. This human dip needle is an ordinary lumber jack, and can rub a steel knife blade briskly with his fingers and then pick up 10-d. nails with the same facility as one would with a regular magnet. He can burn the flesh of another person's hand by rubbing it, and he is so heavily charged with magnetism that a watch carried by him will soon be affected." We presume there will shortly be no more iron lands left for our great steel corporations, unless this man's backers intend to be kind to them.

According to George Paish, editor of the *Statist*, the annual savings of the people of the United States are about $5,000,000,000 per year. These savings are mainly invested in new houses and buildings. The population of the United States is growing at the rate of about 1,400,000 per annum, and mere housing involves the construction of over 300,000 new dwellings *per annum*. Business premises must also be erected, and "it is clear that the aggregate sum expended each year upon buildings of one kind and another is at least $2,000,000. This is, of course, irrespective of the large sums expended upon furnishing them, and in the case of factories and plants of providing them with machinery." The railways require a capital outlay of $60,000,000 per annum, and tramways $250,000,000. The borrowing of municipalities amounts to $250,000,000. "The savings of the American people are equal to an average of at least $60 per head of population, and excluding children, to about $100 per head of population. With so vast a sum available, it is evident that the prosperity of the United States is built upon foundations of a very firm and solid character."

Correspondence and Discussion

British Mining Investments in Mexico

It may be called folly to take issue with so eminent an engineer as Alfred James but I must say I do not consider the premises in his article in the JOURNAL of Feb. 25, are well taken. As the explanation for the failure of numerous "outside mines" in Mexico. Mr. James gives the disinclination of those companies to secure the services of engineers of the highest class. No doubt this does in part account for many failures but the matter warrants closer consideration. We may say that fine grinding improves extraction in cyaniding but the point at which the cost of pulverizing equals the additional recovery effected must not be exceeded. Just so, in this matter, it is not a question entirely of who is the best man to be found, but, how high priced a man can the company afford to employ. Many a promising mining enterprise has been knocked in the head by incurring excessive expense for expert consultation. The solution for the company in the development stage of its growth is, in my opinion, to secure the advice or services of the best men it can afford to employ—above all exercising care to secure thoroughly trustworthy men—act on the advice of these men and then make certain that the affairs of the company are run according to sound business principles. I believe that more failures can be attributed to the dishonesty of those in control and to lack of good business methods in conducting affairs than to failure to secure the best possible technical advice.

Many small mines in Mexico, United States and Canada are today being successfully operated by young, energetic, honest engineers. When absolutely necessary, such men call for the advice of more experienced engineers, but more often they work out their own problems and by conscientious effort earn dividends for the stockholders.

R. MAXWELL BULL.

Pittsburg, Penn., Feb. 29, 1911.

Accidents in American Coal Mines

In the discussion as to the greater prevalance of accidents in our coal mines than in Europe, certain conditions peculiar to our coal deposits are generally left out of consideration, though they may have some bearing on the subject.

(1) Both in the East and in the West our coal beds are more horizontal than, as a rule, those of either England or the north of Europe. The liability of accidents from falling roof is, of course, greater than when the beds have a steep dip. The deaths and injuries from this cause are, apart from the holocausts due to explosions, more numerous than from any other. May this horizontality of our coal beds (for instance, those of the Trinidad field, of Colorado and New Mexico, where there have been seven disastrous catastrophes in 13 months), not account for the greater number of explosions than occur in mines opened upon coal beds with a steeper dip, from which explosive gas may more readily escape to the surface?

(2) May not another explanation of the greater frequency of explosions, especially in our western mines, be the unstable chemical condition of our Tertiary coals? Their percentage of volatile is high, and they are in the process of transformation into the more stable condition of the older coals of the Cretaceous and Carboniferous series.

I merely throw out these considerations for discussion. We may dismiss the popular explanation that our coal companies value dollars more than human lives, and are careless as to the sufferings of the injured and the sorrows of those who mourn for the dead.

JAMES DOUGLAS.

New York, Feb. 18, 1911.

Views, Suggestions and Experiences of Readers

The University Situation in California

The extent to which efforts to boom a certain section will cause men entirely to lose sight of the effect of their work on all other than their private interests is truly astonishing. The people of California have a vivid example of this before them now in the attempt of a number of real-estate boomers and politicians to establish a so called California Institute of Technology at Pasadena.

In the University of California, at Berkeley, are incorporated various technical colleges. These institutions are well housed and equipped, are well attended and have established rank among the foremost technical schools in the world. The mining college in particular is of unquestionable eminence, having attracted attention on account of the success of its graduates. The colleges of mechanical, electrical and civil engineering are also of high standing, and are all a great credit to a great State. The technical schools comprise the most expensive part of the university.

The bill now before the State legislature proposes to provide an endowment of $1,000,000 for a separate technical school in the southern part of the State. The school that it is proposed to raise "to the rank of the Massachusetts Institute of Technology" is a little "fresh water" high school, known as Throop Polytechnic School, at Pasadena, that has for years been attempting to do high-school work with a moderate degree of success. If this movement were successful it would spell mediocrity for both institutions.

Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching, attributes the present high standing of the University of California to the centralization of all State collegiate work in one university. He says: "The whole process of competition between State colleges is demoralizing. It means low standards, political log-rolling and waste of the State's money." In this instance the condition is even more serious, as the present effort to boom southern California can only be successful at the expense of the magnificent educational structure that the State has built at Berkeley.

The same spirit that moves those behind this enterprise has led to the expenditure of millions of dollars of the people's money for establishing navy yards up rivers that are not navigable for the ships of our navy. It seems to be about the time for the heralded "native son" pride to step in and save the reputation of California's great university for her people.

JOHN TYSSOWSKI.

New York, Feb. 28, 1911.

Oiling Tramway Track Cables

In the issue of the JOURNAL for Feb. 18, on page 359, is described and illustrated a car for automatically oiling aërial-tramway track cables, as used on the line built for the Balaklala Consolidated Copper Company. It is stated that this car was designed at the mine. This is incorrect; the car was designed by the Trenton Iron Company and furnished as a part of the tramway equipment.

WILLIAM HEWITT,
For the Trenton Iron Company.

Trenton, N. J., Feb. 23, 1911.

Large Rand Amalgamation

By Rowland Gascoyne*

The announcement of the approaching amalgamation of the Randfontein South mines with the Randfontein Central group, has attracted attention on the Rand. The result of such an amalgamation will be to place the Randfontein mines at the head of the producing companies on the Rand. The nominal capital of the amalgamated mines will be £4,500,000, with a reserve for future developments and extension of half a million sterling.

This huge undertaking covers an area of 2150 claims held under *mijnpacht* and claim title and the claims having the steepest dip of any now worked on the Rand insures a high yield per claim. There will be 1000 stamps available for milling purposes; a 600-stamp installation now rapidly approaching completion and known as the Rand Central mill, and a 400-stamp mill with tube mills at the Randfontein South group of mines. The East Rand Proprietary mines, at present the premier gold producer on the Rand has 820 stamps and 25 tube mills and crushes monthly 186,000 tons for an output of 60,000 oz. of gold, while the Crown mines, the next producer, has 675 stamps with 15 tube mills, crushing 120,000 tons for 50,000 oz. The effect of this amalgamation ought to be that, as soon as the big mill of 600 stamps gets to work in anything like full swing, the Randfontein property will outdistance all its competitors for first position, as it will produce at least 12 per cent. of the Transvaal output and about four per cent. of the world's output.

Randfontein Central Mill Largest in the World

What is known as the Randfontein Central mill, now fast approaching completion, is the largest in the world, having 600 stamps, each weighing 1650 lb., arranged in units of 10, four king posts to each unit with the cam pulley midway on the shaft, each 20 stamps being driven by 100-h.p. motors. The equipment differs essentially from that of the City Deep in that the whole of the framing is of timber with timber pads under the mortar boxes, a layer of bitumastic concrete being placed under the concrete pile blocks. A tunnel into which the bolts converge runs the whole length of the mortar-box foundations, the pulp being conveyed direct to the fixed tables in the gold-recovery house without prior amalgamation.

The attempt has been made to restrict the use of timber in the construction of the mill to the approaches where it was thought advisable to use same. The building, however, is a steel structure 635 ft. long and 70 ft. wide. The original intention was to have 16 tube mills, 36 steel tanks of 60-ft. diameter, the slime plant consisting of 23 tanks of 70-ft. diameter with 14-ft. sides and 7-ft. coned bottoms. The steel-frame gold-recovery house, 310x70 ft., will contain the amalgamation plates, five Betty zinc lathes, six 24-in. filter presses and 40 steel extractor boxes.

More Tube Mills Needed

This mammoth ore-reduction works was first designed to treat 1,900,000 tons per annum, but is intended materially to increase its capacity under the amalgamation scheme by following the latest ideas on the Rand of adding tube mills without increasing the number of stamps. In fact, under modern ideas of ore treatment on the Rand, the 600-stamp mill is considered unnecessarily large, but this mill was commenced before these ideas had gained ground so that the amalgamation scheme will enable this huge ore-reduction equipment to be brought into line with modern Rand practice besides saving capital expenditure on the other reduction plants of the amalgamated company. The combined capacity of the two existing plants is 3,000,000 tons per annum, which can easily be increased by another half-million tons. There are over 6,000,000 tons of practically 7-dwt. ore developed already in the mines of the amalgamated corporation.

*Mining engineer, Box 1078, Johannesburg, South Africa.

Geological Survey and Bureau of Mines Appropriations

Washington Correspondence

The House of Representatives has passed the sundry civil appropriation bill in which are carried appropriations for the Geological Survey and for the Bureau of Mines for the coming fiscal year. No change was made in the appropriations on the floor and it is expected that they will go through the Senate either before March 4, or at the extra session shortly to be called, with little or no modification.

The appropriations for the Survey are as follows: Director and office force of 29 persons, $35,340; 11 scientific assistants, $29,900; general expenses of survey, including skilled laborers and temporary employees, $20,000; topographic surveys in various portions of the United States, to be immediately available, $350,000; geologic surveys in various portions of the United States, to be immediately available, $300,000; chemical and physical researches relating to the geology of the United States, including researches with a view to determining geologic conditions favorable to the presence of deposits of potash salts, $40,000; preparation of illustrations of the Geological Survey, $18,280; preparation of the report of the mineral resources of the United States, $75,000; gaging the streams, underground waters, etc., of the United States, $150,000; library, $2000; engraving and printing geologic maps, $110,000; in all, for the U. S. Geological Survey, $1,205,520.

The appropriations for the Bureau of Mines are as follows:

For the general expenses of the Bureau of Mines, including the pay of the director and the necessary assistants, and for every other expense requisite to the

Randfontein Central No. 3 Shaft

The Randfontein Central Mill

general work of the Bureau of Mines in Washington and in the field, to be expended under the direction of the Secretary of the Interior, $54,000; investigations as to the causes of mine explosions, methods of mining, especially in relation to the safety of miners, the appliances best adapted to prevent accidents, the possible improvement of conditions under which mining operations are carried on, the use of explosives and electricity, the prevention of accidents and other inquiries and technologic investigations pertinent to the mining industry, $310,000; analyzing and testing of the coals, lignites, ores and other mineral fuel substances belonging to or for the use of the United States, $100,000; for tests or investigations authorized by the Secretary of the Interior, other than those performed for the Government of the United States, a reasonable fee covering actual necessary expenses shall be charged, according to a schedule submitted by the director and approved by the Secretary of the Interior, who shall prescribe the rules and regulations under which such tests or investigations shall be made and under which such fees shall be charged and collected. All moneys received from such fees shall be paid into the Treasury to the credit of miscellaneous receipts; salaries of two mine inspectors, authorized by the act approved March 3, 1891, for the protection of the lives of miners in the Territories, $5000; and said inspectors are hereby authorized to inspect coal and other mines in the District of Alaska, to which district the provisions of said act, except so much as requires six months' residence in a Territory prior to appointment, are hereby extended and made applicable; per diem allowances, subject to such rules and regulations as the Secretary of the Interior may prescribe, in lieu of subsistence at a rate not exceeding $3 per day each while absent from their homes on duty, except while in Alaska, when such allowance shall be at the rate of $5 per day, and for actual necessary traveling expenses of said inspectors, including necessary sleeping-car fares, $4500; library, $2000; total for the Bureau of Mines, $475,500.

The appropriations for the Geological Survey are substantially the same as last year. The Bureau of Mines appropriations are, of course, new.

Nomenclature of Iron and Steel

Dr. Henry M. Howe writes in regard to his article on the "Nomeclature of Iron and Steel," in the JOURNAL of Feb. 18, 1911, that on p. 378, col. 2, sec. 20, phrase 4 the words "malleablized cast iron" should read "malleablized iron," and that on p. 357, col. 3, par. 4, l. 3 "difference" should read "diffidence."

Direct Determination of Hydrogen

A direct method for the determination of hydrogen in gases described in the *Chem. Trade Journ.* (p. 224, 1910) consisted in its absorption by a 2 per cent. sodium-picrate solution, containing 2 per cent. of a colloidal preparation of palladium. The palladium acted only as a catalytic agent, and since the solution became slow with age, unless the palladium could be recovered completely as a colloid, the method was too expensive for general use. A method for such recovery is now given.[1] When the solution becomes slow, through reduction of the picric acid to triaminophenol, remove it from the pipette, and add sulphuric acid cautiously until no further precipitation ensues. This requires care as with excess of acid and the presence of atmospheric oxygen palladium sulphate may be formed, which is soluble, and might be lost. The precipitate contains the colloidal palladium, the protective colloid (sodium protalbinate) used by the makers[2], and some unreduced picric acid. Wash this precipitate, paying no attention to the yellow color of the washings, as this is due to picric acid and not to palladium.

Suspend the washed precipitate in water and add sodium hydrate cautiously until the precipitate just disappears. Add sodium picrate, and the solution is again ready to use. While the originators of the method (Paal and Hartmann) use a 2 per cent. picric-acid solution, Brunk recommends 5 grams sodium picrate per 100 cc. of solution. Tedious shaking of the pipette is avoided by using the phosphorous type of pipette filled with glass balls. Beads are not used, as they entangle gas bubbles.

The manipulation is simple. Pass the gas into the pipette and return after 5 minutes to the measuring tube, pass again into the pipette, allow to remain five minutes longer and again remeasure. Continue this procedure until the gas attains a constant volume. Brunk has used the method for some time, and recommends it as both accurate and convenient.

Arizona Copper Company

During its fiscal year ended Sept. 30, 1910, the Arizona Copper Company produced 32,210,000 lb. of copper from 754,187 tons of ore, the average yield having been 42.64 lb. per ton. Of the ore extracted, 96 per cent. was of concentrating class, and 4 per cent. direct-smelting. The average rates of concentration was 5.14:1. The smeltery treated 158,532 tons of ore and concentrates the average yield having been 10.14 per cent. copper.

The cost of mining, smelting, etc., was £632,566; of general charges, £31,344; total, $663,910, or $3,230,586. This is equivalent to 10.3c. per lb. of copper. Plans are under way to rebuild the smelting works.

[1] *Chem. Zeit.*, Dec. 15, 1910; abstracted in *Chem. Trade Journ.*, p. 29, 1911.

[2] Kalle & Co., Biebrich a. Rh., Germany.

Chronology of Mining for February, 1911

Feb. 5—Announcement that Bewick, Moreing & Co. would investigate the Porcupine district, Ontario.

Feb. 6—Three men killed at the mine of the Independent Coal and Coke Company, at Kenilworth, Utah, by striking Greek miners.

Feb. 9—Explosion at Cokedale mine of American Smelting and Refining Company, near Trinidad, Colo., killed nine men.

Feb. 14—The mill of the Veta Colorado company, at Parral, commences crushing.

Feb. 15—President Taft signs the Kahn bill officially declaring San Francisco the site for the Panama Canal Exposition in 1915.

Feb. 18—The 40-stamp mill of the Tajo de Dolores mine of the Proprietary Mines Company begins crushing.

Feb. 23—Fire in the Belmont mine, Tonopah, Nev., traps a dozen men.—The Interstate Commerce Commission decides against the proposed advance in freight rates.

Feb. 26—Fire discovered in the Hazel mine of the Pittsburg-Buffalo Coal Company, near Canonsburg, Penn.

February Dividends

The accompanying table shows the amount per share and total amount of dividends paid during February, 1911, by a number of the leading mining and metallurgical companies in the United States, Canada and Mexico.

U. S. MINING COMPANIES.	Situation.	Amt. per Share.	Total Amt. Paid.
Amalgamated, c	Mont.	$0.50	$769,439
Arizona Cop., com	Ariz.	0.30	461,665
Boston & Montana, s.	Mont.	4.00	600,000
B'k'r Hill & Sul., l.s.	Ida.	0.25	81,750
Homestake, g	S. D.	0.50	109,200
Mohawk Min., c	Mich.	1.00	100,000
Mon. Madonna, g.s.l.	Colo.	0.01	10,000
Parrot S. & C	Mont.	0.15	34,477
Toulumne, c	Mont.	0.15	120,000
U. S. INDUSTRIALS.	**Situation.**	**Amt. per Share.**	**Total Amt. Paid.**
Cambria Steel	Penn.	$0.62½	$562,500
Inter'l Nickel, pf.	U. S	1.50	133,689
Jeff. & Cl'f., C. & I.,pf.	Penn.	2.50	37,500
Lehigh C. & N.	Penn.	1.00	482,956
U. S. Steel, pf.	U. S.	1.75	6,304,919
FOREIGN MINING COMPANIES.	Situation.	Amt. per Share.	Total Amt. Paid.
Amparo, g.s.	Mex.	$0.03	$60,000
Buffalo, s.	Ont.	0.05	50,000
Conlagas, c.	Ont.	0.45	360,000
Dominion Coal, pf.	N. S.	3.50	175,000
Lucky Tiger, com., g.	Mex.	0.05	35,750

Details of Practical Mining

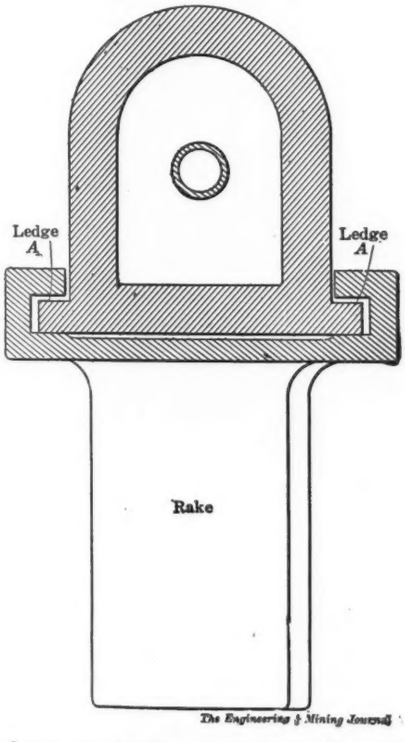
This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent of telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Improved Rake and Arm for McDougal Furnace

In roasting ores with the McDougal furnace, one of the constant sources of expense is the replacement of the rake arms.

The standard rake (shown in Fig. 1) becomes sulphated up to the ledge *A*, causing it to break, and frequently it is also necessary to break and remove all

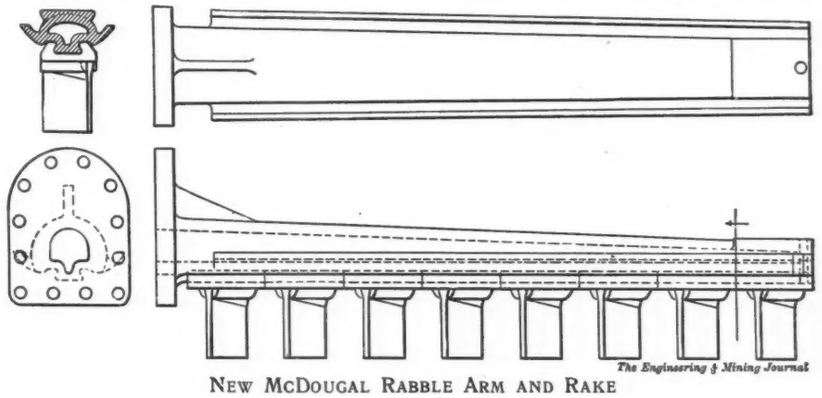


ORDINARY MCDOUGAL RABBLE ARM AND RAKE

the outer rakes if an inner one is to be replaced.

To overcome this, an arm and rake (Fig. 2) were designed[1] by Capt. William Kelly, general foreman, and H. N. Thomson, former assistant superintendent, of the Washoe smeltery. The figure shows the method of attaching the rake, and the water-cooled dovetailed surface of the arm that acts as the support for the rake. This combination has been in use for nearly two years, and has been satisfactory, as there is no adhesion, of any moment, between the rake and the arm.

[1]U. S. Pat. 940,488.



NEW MCDOUGAL RABBLE ARM AND RAKE

Adding Lime to Cyanide Solution

At the cyanide plant of the North Star Mining Company, at Grass Valley, Cal., a simple method of adding lime to the cyanide solution is used. Enough lime is slacked in a small box to supply the mill for 12 hours. This supply is then fed into a gold pan, such as was formerly used for grinding concentrate, in six approximately equal portions, at intervals of two hours. The muller of the pan makes about one revolution per minute, and is driven by a small water wheel. The muller is loosely hinged to the driving spider and as it slowly rotates, it breaks up the lumps of lime on the bottom of the pan and slightly stirs the slacked lime into a thin emulsion. Water is added to the pan, the supply being regulated by a faucet, causing a constant overflow of milk of lime into the cyanide solution.

The strength of the overflowing milk of lime is not constant, but nearly so. Although a considerable amount of lime is let into the pan at one time, the muller stirs up only a small quantity; and most of the coarse particles settle back to the bottom of the pan, so the solution is kept fairly uniform.

Gas Producer Linings

Lining a gas producer with firebrick set up hard against the metal shell is likely to bring about a great deal of trouble. In this case the brick soon begins to crumble and crack, owing to its expanding against the unyielding surface of the shell, after which air passes up through the lining, reducing the efficiency of the plant. If the brick is not set tight against the shell, some provision must be made to keep air from passing between the shell and the brickwork.

C. A. McGahey[1] recommends using asbestos or magnesia to fill this space, which he says should be about 1¼ in. wide. The asbestos should be put in as the brickwork is built up, and the bottom layers tamped. This serves both as a cushion for expansion and a lining to prevent the upward passage of air.

[The use of cellular magnesia or asbestos packing for this purpose is patented, but sand serves the same purpose. The use of sand in this connection recalls the practice of putting sand over the roofs of reverberatory furnaces to prevent the waste of heat. If used near the firebox, care must be exercised, as it may cause undue burning out of the brick, but it can sometimes be used on the arch near the "verb" to advantage.—EDITOR]

Kenneth Williams reports that increased litharge has the effect of decreasing silver recovered in ore assays (*Journ. Ind. and Eng. Chem.*, Aug., 1910). The averages of his results are: With 25 grams litharge, ½ a.t. of ore, 40.41 oz. silver, per ton; with 50 grams litharge, 40.25 oz. per ton; with 75 grams, 40.06 ounces.

[1]*Power*, Feb. 7, 1911.

The Borcherdt Automatic Sampler for Sands and Slimes

By W. O. Borcherdt*

From time to time there have appeared in the Journal descriptions of various forms of mechanical samplers, especially intended for the sampling of sands and slimes, such as the feeds and tailings of sand jigs, tables and vanners. Of those that have come to my notice usually some defect, such as too great complexity or inability to take an accurate sample, has made them impracticable for ordinary mill use, where simplicity, combined with effectiveness, is essential.

All these devices have one point in common, their reliance upon outside power to cause them to function, whether it be applied from the mill shafting or through the medium of a water supply and the familiar tipping trough. As it is frequently desired to use an automatic sampler at a point in the mill, or its environs, where power is not readily available, a sampler should prove useful, which, besides combining the elements of simplicity, accuracy and sturdiness, is also independent of any power other than that derived from the pulp flowing through it.

Having need, in connection with table tests carried on during regular mill operations, of a sampler that would fulfil the above mentioned conditions, as well as operate in the only available place, without the expense of bringing power to it, I devised the machine shown in detail in the accompanying illustrations, which has admirably fulfilled expectations, and has operated for about a year with little attention and no cost for repairs or renewals.

*Assistant superintendent, Bertha Mineral Company, Austinville, Va.

Sampler Has Only One Moving Part

Referring to Fig. 1, showing the general arrangement, it will be seen that the single moving part of the sampler consists of a wheel composed of a sheet-steel rim and a wooden center, or hub, joined to the rim by a number of equally spaced sheet-steel vanes, or blades, extending from side to side in the plane of the axis. In the sampler illustrated, No. 18 U. S. Standard sheet steel is used for the vanes, which are radial and are secured in saw cuts in the hub merely by friction, while their outer ends are locked together and to the rim by means of wooden lock strips, with sides cut to the radial bevel, and driven in simultaneously so as to preserve correct spacing and the circular contour of the rim. At *B* in Fig. 2, is shown the butt joint of the rim. Strap rivets are countersunk on both sides. This joint should counterbalance the sample bucket.

The number of open cells thus produced is suited to the size of the wheel and percentage of sample cut desired. In the sampler illustrated, which is as small as advisable, 50 divisions, making a 2 per cent. cut, are used. The hub is turned in a lathe, the space marked off with dividers and the grooves made with a back or miter-box saw. After inserting the vanes and lock strips in the rim the wheel is turned in the lathe, and the upper end of the hub faced square and counterbored to pass the free end of the bearing spindle. The lower end of the hub is also bored out as indicated, to form a drip edge around the circumference. These details are illustrated in Fig. 2.

One of the open cells is then closed off on the bottom with a wooden filler, sealed with thick paint, and a slot cut from it to the center of the hub which connects it to a close pipe nipple screwed into the center of the lower face of the hub. A ball bearing, in this case simply the rear hub of a bicycle, is fastened to the upper face of the hub by means of wood screws passing through holes drilled and countersunk in the regular sprocket and the entire wheel is suspended by this bearing from a small iron plate bolted to the under side of the feed box, as shown in Fig. 1.

From the sides of the feed box near the bottom issue pipe nipples, which carry elbows into which discharge pipes of the proper length are screwed, below the sample wheel, and so arranged that no pulp can enter it except that discharged from the sample bucket, is a small cup with closed bottom from which a pipe leads the sample to the receptacle in which it collects until removed.

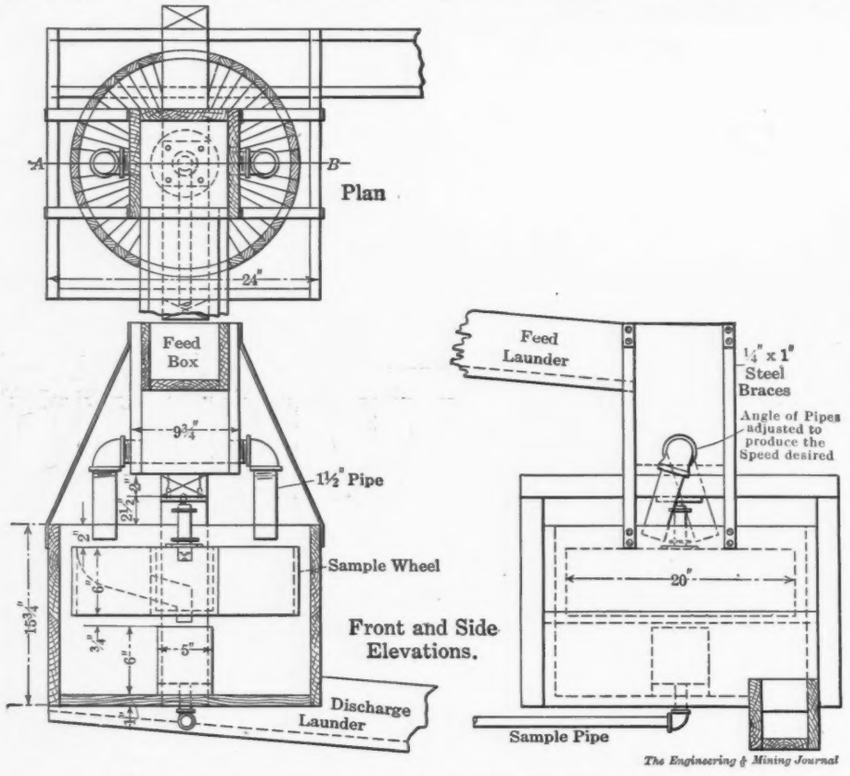


Fig. 1. General Arrangement of the Borcherdt Sampler

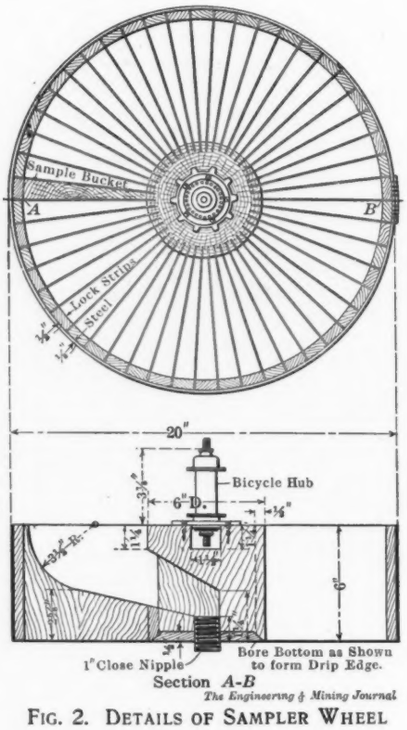


Fig. 2. Details of Sampler Wheel

Sampler Is a Crude Turbine

As will at once be evident, the whole machine is simply a crude form of turbine, in which the pulp to be sampled

furnishes the motive power, and as all the pulp is discharged through the wheel, and as all of the cells are equal and open save one, it follows inevitably that the single closed cell or bucket catches and conveys away its definite proportion of the whole pulp, regardless of the quantity of pulp (within the limit of the capacity of the sample bucket), the speed of the wheel, or the number of pipes delivering the pulp.

In use, the angle of the discharge pipes to the surface of the wheel is adjusted by turning the elbows on the thread of the horizontal nipples until the speed of rotation is as desired, generally between 30 and 60 r.p.m. This gives a large number of cuts per minute, and

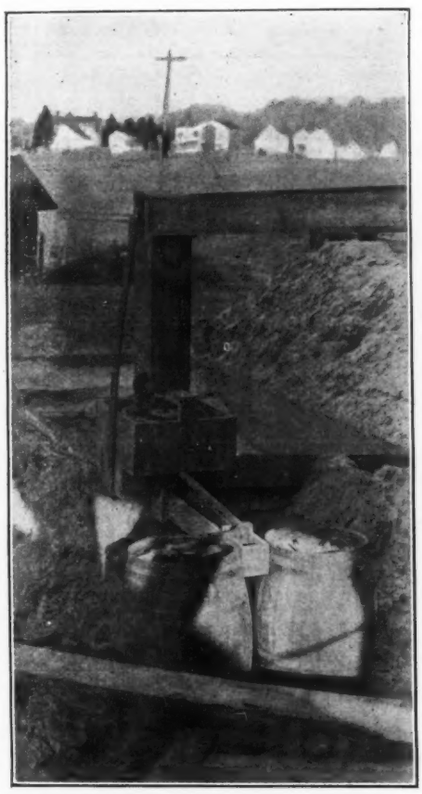


FIG. 3. THE BORCHERDT SAMPLER AT AUSTINVILLE, VA.

at the same time the wheel works without splash and requires oiling only about once a day.

ADJUSTMENT OF SAMPLER EASILY EFFECTED

In adjusting the sampler to suit given conditions as to head available and quantity of pulp to be handled, two variable factors enter, which permit of considerable latitude. Any number of discharge pipes may be used on the feed box but it is best to make the number even and to space them equally on account of maintaining the wheel in balance. The number and size of these pipes can be increased when only a low head is available, while with the opposite conditions fewer and smaller pipes may be used, and the head in the feed box, measured from the lower ends of the discharge pipes to the bottom of the feed launder (dimension *X* in Fig. 1), may be increased sufficiently to flow the quantity of pulp required.

For example, the small sampler illustrated handles the tailings, including all the head water, of five tables, amounting normally to 66 gal. per min., carrying 80 lb. per min., or 2.4 tons per hour of solids ranging between 1 mm. and slime. It has been loaded to 82 gal. per min., the limit of capacity of the Frenier pump handling these tailings, without showing any splash, and it is probable that this size would take as much as 100 gal. per min. cutting a 2 per cent. sample, as at 50 r.p.m. the same bucket would only have to handle a little less than one-quarter pint per revolution.

MODIFICATIONS NECESSARY TO ALTER CAPACITY

In this particular machine the head from the end of the two 1½-in. discharge pipes to the bottom of the feed launder is 3 ft. 10 in., ample to care for 100 gal. per min. of pulp of the density stated. The rear hub of a bicycle, with its sprocket, forms an ideal bearing for the small-size sample wheel, but as the size is increased above 24 in., it is advisable to use a motorcycle hub, which, with a ½-in. spindle, provides a bearing strong enough for a 36-in. wheel. This, with a hub 12 in. in diameter and 100 blades, would easily care for 500 gal. per min., and take a 1 per cent. sample.

If it is desired to handle denser pulp than 4 or 5:1, or coarser than about 1 mm., the sample wheel should be modified so as to make its depth greater in proportion to its diameter in order to run the sample quickly out of the sample bucket, and in all cases the speed of the wheel should be kept moderate in order to avoid the retarding effect of centrifugal force on the discharge of the sample.

It is, of course, evident that the sample bucket could be arranged to discharge from the outer circumference of the wheel into a circular gutter or launder, but as this arrangement occupies more space and takes greater mill head, it is generally preferable to use the central discharge.

SAMPLER PROVED TO BE ACCURATE

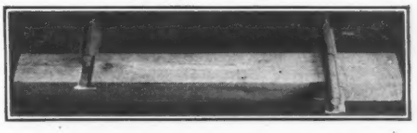
Frequent tests with measured weights have shown that this sampler, under all operating conditions, cuts the definite percentage intended, and a convenient means is thus provided for measuring the flow of pulp in a launder, or figuring the tonnage handled by the fines department, since the weight of sample collected multiplied by the percentage factor of the sampler gives the total tonnage passed.

A convenient means of collecting the sample consists in piping it from the sampler to one of two oil barrels stood on either side of the pipe which has an elbow even with the center of the top of the barrels, from which leads a piece of pipe long enough to reach across and dip below the water level in one barrel. The barrels are used alternate days and are put in service merely by swinging the end piece of pipe on its elbow so as to discharge into the other barrel. The illustration of the sampler used at Austinville, Fig. 3, shows the arrangement. The overflow from the barrels is clear, and the collected sample is prepared for the drying oven by stirring up the settlings with that part of the supernatant water which cannot be dipped or siphoned off clear, and pouring the mixture through a riffle sampler until a sample of the desired size results.

Handy Wooden Sleeper

BY R. H. COULSON*

A handy form of wooden sleeper for use with light rails has been designed by Henry Houghton, a Lancashire colliery manager, and is shown in the accompanying illustration. Grooves are cut near each end of the sleeper to fit the base of the rail, as shown, at such a distance



WOODEN SLEEPER FOR PORTABLE TRACK

apart as to keep the rails at the desired gage. As many sleepers as are necessary for one section of track are threaded on the base of the two rails and spaced at equal intervals along their length. A section of track may be quickly laid by using these sleepers, and a change from one part of a drift to another can be made without the delays incidental to spiking rails to sleepers.

When cutting pipe threads in a lathe it is sometimes difficult to get the exact diameter necessary. When a mistake is made and the threads on a 6-inch pipe are cut a trifle too small, so that it screws right up to the shoulder, then it remains for the workman to get out of the trouble the best way he can. A good way, according to *Power*, Feb. 7, 1911, is to use wire cloth of the brass variety, about 60 or 80 meshes to the inch, similar to that used by the farmer for straining milk. Wrap a bit of wire cloth around the pipe, daub it with litharge or red lead and screw the pipe home with the wire cloth in the joint. This joint will never leak or come loose.

*Wigan, England.

The Abuse of Conveyer Belts

By John J. Ridgway*

It is an unfortunate fact that the purchaser or user of newly introduced labor-saving devices has to depend on the producer for such information as is necessary to determine the advisability of its introduction and purchase. If the effort were always to arrive at the facts, unprejudiced by the impress of the almighty dollar, this information might be relied upon, but unfortunately deficiencies are either evaded or avoided and when it is too late the purchaser learns to his sorrow where the trouble lies.

The engineer in charge of the construction of new plants or the renovation of old ones has often an uncertain plan of operation for the introduction of something initially undecided upon, and leaves a space for the installation of the belt conveyer so circumscribed as to occasion unavoidable wear and tear, and the purveyor, thinking more of the immediate profit than of the ultimate effect on his reputation and the reputation of the article he purveys, concedes what he knows is wrong, to the detriment of all concerned, purchaser, producer and the reputation of the article itself.

Those who have belt conveyers in charge are often thoughtless of the risks they run when they permit a workman, in clearing the transfer chutes, to use a shovel or hoe which might be, and is often dropped from various causes—being struck with pieces of heavy material, through the man's foot slipping or some unusual sound like the pistol shot of electric contact broken at the switchboard—and before anything can be done, hundreds of dollars worth of damage has been occasioned, when the remedy for this is equally simple. The instrument used to clean these transfer chutes ought to be attached by chain or otherwise, so that by no possibility could it drop through and do the damage above described, and yet without prejudice to the performance of its proper function.

Conveyer belts are often left fully loaded and without the necessary motor control are started up full speed, a condition absolutely unjustifiable and yet one that often occurs. The troughing idlers are often constructed more for the immediate convenience of their individual manipulation than with the thoughtful consideration of the wear and tear of the belt which first, last and always being the large item, ought to be considered first. In my judgment, pulleys in line, when driven, have a tendency to act like a pair of shears, and this is continuous and intensified when the loads are heavier than they ought to be or the carriers are spaced too wide apart, and is a fruitful source of destruction to the belt. As a rule, in belt conveyers of any appreciable length, the belt represents at least two-thirds of the initial cost of installation, and it would hardly seem the part of wisdom to prejudice two-thirds which is subject to constant wear, for a saving in one-third which, in the nature of the material and the character of the work that it performs, under proper care and management should last almost indefinitely. Such, however, is the case.

In all other kinds of mechanical devices the construction and adaptability of the article in question is always the prime consideration in making a choice and this maintains in conveyer belts, or should, more so than in most things, because of its large initial cost and its liability to injury through misuse and abuse. The criterion of merit in an article for commercial uses is that it should represent, in service or efficiency, the greatest possible return for the amount of money expended, and right here comes in the everlasting question of last cost. I know of cases where conveyer belts have cost $12 per ft., in contrast with others that have cost $1.75 per ft., operating for the same time, under almost identical conditions and handling the same type of material. In the first case the sharp pencil was used with telling effect on the figures of first cost of the belt, and in the second case a more far-seeing judgment was exercised.

*207 Fulton street, New York.

Lead chromate is being tried in India as an insecticide, in order to avoid the danger of arsenic compounds.

Power Required to Haul Cars on Various Pitches

The sixth chart in the series prepared by L. F. Mitten, of the Vulcan Iron Works, is intended to simplify the calculations for determining the power required to haul loads on planes of various pitches. For example, it is desired to haul two loaded cars, each weighing 6000 lb., up a plane 1000 ft. long, having a pitch of 40 deg. from the horizontal, at a maximum rope speed of 500 ft. per min. What is the equivalent rope pull? What is the brake horsepower required to handle the load? Two loaded cars weighing 6000 lb. each equals a load of 12,000 lb. exclusive of winding rope. Referring to the accompanying diagram follow the horizontal line representing 12,000 on the chart until it is intersected by the diagonal line representing 40 deg. Directly above this point of intersection will be found the rope pull, which in this case is 7900 lb. It is also found that a ¾-in. rope will be satisfactory and that this size rope weighs 0.88 lb. per ft. Following down this imaginary line representing 7900 lb. until it is intersected by the diagonal line representing 500 ft. per min. rope speed, one finds 120 h.p. applied to the load, or the brake horsepower required. The horsepower to be delivered by this hoist motor would be 141; this is based on an efficiency of 85 per cent. for the entire equipment. It has been found that a ¾-in. rope would be required and also that this size rope weighed 0.88 lb.

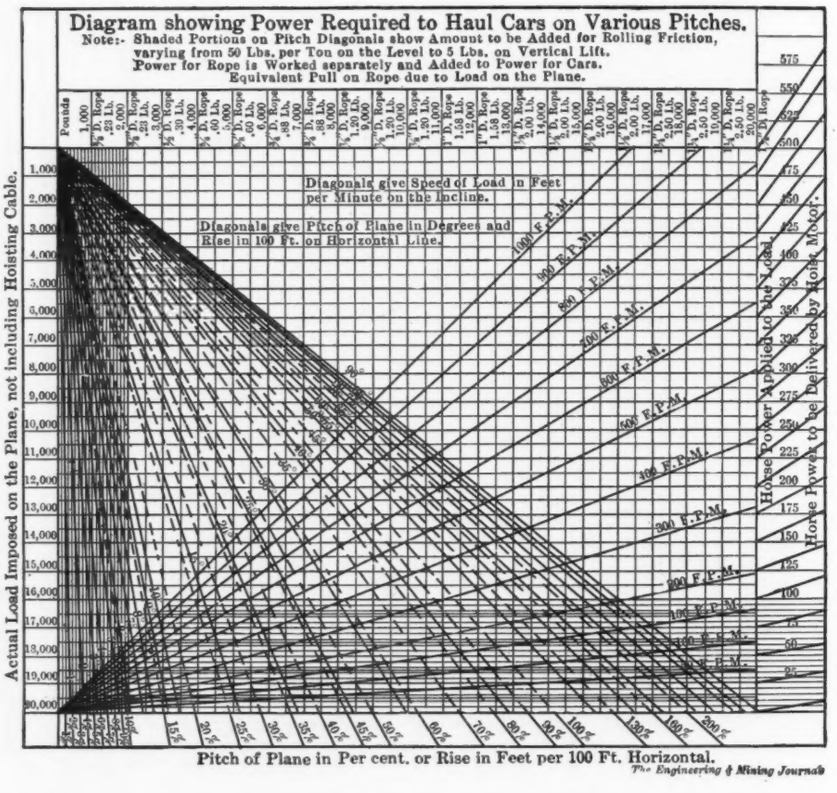


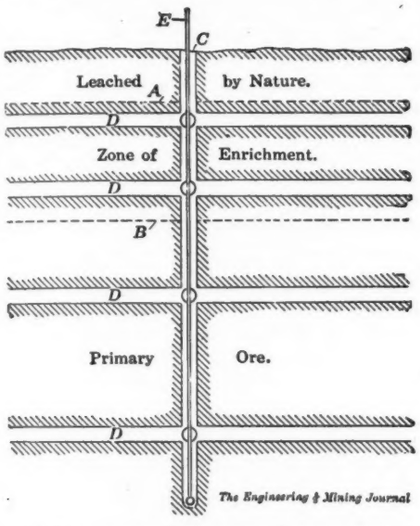
Diagram showing Power Required to Haul Cars on Various Pitches.
Note:- Shaded Portions on Pitch Diagonals show Amount to be Added for Rolling Friction, varying from 50 Lbs. per Ton on the Level to 5 Lbs. on Vertical Lift.
Power for Rope is Worked separately and Added to Power for Cars.
Equivalent Pull on Rope due to Load on the Plane.
Diagonals give Speed of Load in Feet per Minute on the Incline.
Diagonals give Pitch of Plane in Degrees and Rise in 100 Ft. on Horizontal Line.
Actual Load Imposed on the Plane, not including Hoisting Cable.
Horse Power Applied to the Load.
Horse Power to be Delivered by Hoist Motor.
Pitch of Plane in Per cent. or Rise in Feet per 100 Ft. Horizontal.
The Engineering & Mining Journal

per ft.; 1000 ft. of rope at 0.88 lb. equals 880 lb. By working this out as was done for the loaded cars, it is equivalent to 9 h.p., which should be added to the 141 h.p., making a total of 150 horsepower.

Extracting Copper from Ore in Place

The extraction of copper from its ores without first removing the ore from the vein by mechanical means has been made the basis of a patent granted to W. L. Austin. The process consists in leaching the copper from the ore *in situ*, by water or other liquid, collecting the liquid charged with copper, raising it to the surface by pumps, and precipitating the metal on scrap iron or by other suitable means.

The method of applying the process is shown in the sketch. The dotted line



A METHOD OF LEACHING COPPER ORE

A indicates the upper surface of the zone of enrichment, and *B* the top of the zone of primary ore. The line *B* is often the natural drainage level of the locality, determined by the topography. In accordance with the process, an artificial drainage level or collecting reservoir is created below the line *A*, toward which water distributed throughout the mineral-bearing rock will flow, as to the point of least resistance. By means of levels, crosscuts, and winzes, a quantity of water is distributed throughout the deposit, so that the water percolates the rock and flows toward the collecting reservoir.

The report of the Rhodesia Chamber of Mines for October, 1910, states that it has been resolved to ask the government "to consider the advisability of issuing blasting certificates to miners and gangers in underground employ. It is considered that by these means the danger of accidents arising from drilling into misfired holes will be minimized."

How Explosives Should Not Be Used

Miners' Circular No. 1, the first of a series to be written in plain, nontechnical language for the benefit of the miner, has just been issued by the U. S. Bureau of Mines. It contains the names of the permissible explosives tested by the Bureau at its Pittsburg station previous to Nov. 15, 1910, and gives precautions as to their use. Permissible explosives give a short and relatively cool flame that is less likely to ignite inflammable gas or coal dust than is the longer and hotter flame of dynamite or the longer and much more lasting flame of black powder. Because they can be used with greater safety, permissible explosives have taken the place of other explosives in many coal mines in the United States during the last two years and their use is increasing rapidly. To reduce the risks in storing, thawing and handling explosives at coal mines, the following precautions are urged by the Bureau of Mines:

Don't store detonators with explosives.

Don't open packages of explosives in a magazine.

Don't open packages of explosives with a nail puller, pick or chisel.

Don't store explosives in a hot or damp place.

Don't store explosives containing nitroglycerin so that the cartridges stand on end.

Don't repair a magazine until all explosives are removed from it.

Don't use permissible explosives or other explosives that are frozen or partly frozen.

Don't thaw frozen explosives before an open fire, in a stove, near a boiler, near steam pipes, or by placing cartridges in hot water.

Don't put hot water or steam pipes in a magazine for thawing purposes.

Don't carry detonators and explosives in the same package.

Don't handle detonators or explosives near an open flame.

Don't expose detonators or explosives to the sun for any length of time.

Don't open a package of explosive until ready to use, then use it promptly.

Don't handle explosives carelessly.

Don't use more than 1½ lb. of any permissible explosive for one shot in a coal mine.

Don't use a detonator (blasting cap) or electric detonator of less strength than No. 6.

Don't crimp a detonator (blasting cap) around a fuse with the teeth.

Don't economize by using a short length of fuse.

Don't use, in a gaseous coal mine, any fuse or other device which emits flame or sparks.

Don't use coal cuttings or "slack" or any combustible material for stemming.

Don't use a metal tamping rod. A copper-tipped rod is not to be recommended. Wooden rods are safer.

Don't use two kinds of explosives in the same drill hole.

Don't return to the face until at least 5 minutes after a shot has been fired.

Don't breathe the gases from the shot.

Don't return to the face after a misfire for at least one-half hour.

Don't attempt to draw the charge in case of a misfire.

Don't leave any detonators or explosives in a mine over night.

Don't charge or load any hole which has not been properly placed or has been drilled "on the solid."

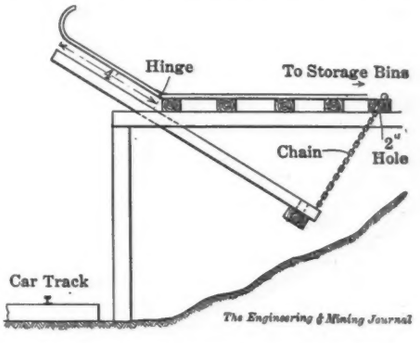
Don't light the fuse of dependent shots at the same time the first shot is lighted.

Don't expect to get satisfactory results with a permissible explosive or any explosive when a miner uses it for the first time.

Don't think the use of permissible explosives can take the place of other safety precautions in mines and thus neglect those precautions.

Tipple for Loading Locomotive Tenders

The accompanying sketch shows an arrangement for dumping coal into locomotive tenders or coal cars where there is but little head room between the level of the track and the bottom of the pockets. With a portion of the track movable, as shown, the car can be run out to the



TIPPLE FOR USE ON LOW LOADING PLATFORM

middle of the railroad car or tender before dumping. When not in use the end of the track stands nearly vertical. A chain is attached to the lower end with which to pull the track in position for handling coal. The rails are not hinged. A heavy strap hinge extends from the tie to 4-ft. sleepers from which the car dumps. A gravity chute is best, but sometimes it is necessary to use other devices.

It is impossible to cupel a button containing nickel and finish it properly. It is necessary to scorify first and to use a large enough quantity of lead to give at all times a fluid alloy and slag.

Canadian Mining Institute

VICTORIA CORRESPONDENCE

The Western branch of the Canadian Mining Institute held its ninth general meeting at Nanaimo, Vancouver Island, B. C., on Feb. 16. Wm. Fleet Robertson, provincial mineralogist, chairman of the branch, presided.

The business of the meeting was related chiefly to coal mining, so there was a peculiar fitness in holding the meeting at Nanaimo. The late Dr. George M. Dawson, in "Mineral Wealth of British Columbia, 1887," after mentioning the discovery of coal in the province in 1835, and some exploratory work done at Suquash, Vancouver island, in the years 1849-1853, stated that: "Meanwhile, in 1850, the existence of coal at Nanaimo had been ascertained, and in the following year it appears that most of the miners were transferred from the northern end of the island to that place. Work began in earnest at Nanaimo in 1852 and, before the close of the next year, 2000 tons of coal are reported to have been shipped, chiefly to San Francisco. The price of coal at this time was, at Nanaimo $11 per ton, and at San Francisco $28. The Hudson Bay Company, under the name of the Nanaimo Coal Company, continued to work the mines thus opened until 1861, when they were sold to the Vancouver Coal Mining and Land Company." The Nanaimo colliery was acquired by the Western Fuel Company, of San Francisco, in December, 1902. Thomas R. Stockett is now manager of this company, and Thomas Graham, superintendent.

PAPERS ON COAL MINING

At the afternoon session, addresses were delivered by the acting mayor of Nanaimo, the chairman, E. W. Parker, of the U. S. Geological Survey, and E. B. McKay. The last-mentioned, who is surveyor-general of British Columbia, in a reminiscent talk, stated that he arrived at Nanaimo from England early in 1875, and had with him the first diamond boring machine ever brought into British Columbia. Several years later he erected the engine and headgear at No. 1 shaft, which has for many years been one of the main outlets from the mine, which during his connection with it was operated by the Vancouver Coal and Land Company.

The papers read in the afternoon were, "First Aid; its Relation to Coal Mining," by Charles Graham, superintendent of the Middlesboro colliery, Nicola Valley, and "Coal Mining in British Columbia," a comprehensive survey of the known occurrences of coal in the province, by C. F. J. Galloway, of Vancouver.

The prominent feature of the evening session, following a brief review of the history of coal mining in the province by the chairman, was an address by F. Napier Denison, of the meteorological office, Victoria, on "Earthquakes, Strains and Stresses, and Their Relation to Coal Mine Explosions," with lantern-slide illustrations. This address proved interesting and instructive, and the coal miners present afterward gave their fellow miners such a favorable account of it, that its repetition before a large gathering of miners is being urged.

MINE ACCIDENT RESCUES

E. Jacobs, of Victoria, branch secretary, gave the meeting an account of the self-sacrifice of Fred C. Alderson, of Hosmer, B. C., who while leading a rescue party after a disaster in the Bellevue mine, Alberta, took off his Draeger helmet and put it on an Italian miner, whose life was thereby saved, while Alderson was overcome by gas and died in the mine. A lantern picture of Alderson was thrown on the screen, and all present rose as a mark of respect to his memory. A resolution was passed expressing appreciation of the action of the British Columbia Government in giving $500 to the fund for the benefit of Alderson's widow and family of four young children. Mr. Stockett announced that the miners employed at the Western Fuel Company's mines had also subscribed $500 to that fund, and the company had added $100 to the amount.

Another incident of the evening's proceedings was the presentation of certificates granted by the United States Bureau of Mines to five men from British Columbia who had taken the mine-rescue training course at the training station at Seattle, Wash. Of these five, four are inspectors of coal mines under the Provincial Department of Mines.

On Friday morning, Feb. 17, at No. 1 mine, the visitors saw a class of four men doing their daily two hours' mine-rescue training work in a chamber filled with noxious and irrespirable gases. There are 24 of the Western Fuel Company's men in training, and it is intended to increase the number to 40, which will be 4 per cent. of the company's miners. This company was the first in British Columbia to obtain mine-rescue apparatus; it purchased a complete equipment before the provincial law requiring coal-mine operators to provide oxygen helmets or some form of mine-rescue device, came into force.

THE MALASPINA GALLERY

Later in the day the visitors were taken to Gabriola island, near the entrance to Nanaimo harbor, to see a singular natural phenomenon—the Malaspina gallery, which has been eroded by winds and waves. Its dimensions are: Length, about 300 ft.; width, 15 ft.; hight from floor to roof, 12 ft. It was discovered on June 15, 1792, by two Spanish naval officers, Galiano and Valdes, after they had anchored their exploring vessels under shelter of the island. The gallery was named after the Spanish officer commanding the expedition, and from his sketch and report its existence was ultimately made known to many other Europeans.

Platinum in Wyoming

It has been reported from time to time that the Rambler mines, at Holmes, Wyo., yielded an ore containing a remarkably high percentage of platinum and metals of the platinum group. These mines are owned by the Rambler Copper and Platinum Company, of which A. C. Dart, formerly connected with the University of Wyoming, is the general manager.

Some time ago Mr. Dart communicated to us some assay reports upon the concentrates that he was then producing. The remarkable character of these is indicated by the accompanying table.

CONCENTRATES FROM RAMBLER COMPANY'S MINE.

Sample.	Per Cent. Copper.	Oz. per Ton Silver and Palladium.	Oz. per Ton Platinum.	Oz. per Ton Gold.	Oz. per Ton Iridium.	Oz. per Ton Iridosmium.
Concentrate from Table No. 1	13.2	9.98	15.20	4.20	0.72	0.12
Concentrate from Table No. 2	14.1	11.80	13.48	3.86	0.24	tr.
Concentrate from Table No. 3	11.7	11.70	9.62	2.46	0.12	tr.
Concentrate from pipe sample	13.7	3.74	8.64	4.78	14.14	1.32

Mr. Dart also sent us samples of the country rock, ore, rich mineral, and also of the concentrate that he was then producing. According to him the last sample was taken from 832 lb. of sacked material.

Assayers of this country are not so well versed in the determination of platinum and allied metals as they are in the cases of gold and silver, and consequently in order to be sure that there had been no mistake in assaying we submitted to Ledoux & Co., assayers and chemists, 99 John street, New York, the sample of concentrates sent to us by Mr. Dart, together with a sample of covellite and of what was considered to be the typical ore of the mine.

REPORT OF LEDOUX & CO.

Ledoux & Co., reported to us as follows:

Concentrates—Platinum, 14.66 oz. per ton; gold, 2.82 oz. The sample contains some silver and considerable palladium,

but no quantitative determination of these metals was made. The presence of a small amount of iridium was also noticed.

Covellite—Platinum, 1.8 oz. per ton; gold, 1.1. A very small amount of palladium was also noticed in this sample. The gold is principally in the free state, separating as metallic scale when the sample is ground. The metallic scale does not contain platinum. This would indicate that the platinum is not present as the native metal.

Platinum Rock—Platinum, 0.25 oz. per ton; gold, 0.03 oz. This sample also contains a trace of palladium. Concentration of the mineral by panning does not show any native platinum, but a small amount of heavy concentrate was obtained which when separated as far as possible from the sulphides present appears to be sperrylite.

Unique as a Platinum Lode Mine

It will be noted that the report of Ledoux & Co. bears out the reports of Mr. Dart.

The Rambler company has been engaged in experimental milling operations and in the installation of water supply, etc., for regular work. We understand that a shipment of concentrates to Eastern smelting works has recently been made. There seems to be no question that the ore of this mine is platiniferous to a remarkable degree and if the mine proves to be commercially workable it will be unique, we believe, as an example of lode mining for platinum. The mineralization appears to be in a decomposed diorite, judging from the samples that we have had.

The Valdez Creek Placer District

Valdez creek is one of the tributaries of the Susitna river that flows into Cook Inlet. The gold production for 1910 was $260,000. The most productive part of the creek, according to a recent bulletin of the U. S. Geological Survey, is in the lower two or three miles of its course. Mining began in 1903 and the richest parts, so far as known, are nearly worked out. The gravel, largely the product of glaciation, is 3 to 8 ft. thick and consists of slate, schist, and granite on slate bedrock. Large granite boulders are difficult to handle and add much to the cost of mining. The freight rates from Valdez approximate 30c. per lb. which with the unusual proportion of boulders in the gravel makes the operating cost high.

A new Swiss works for the fixation of atmospheric nitrogen is reported (*Elect. Rev.*, Sept. 30, 1910) to be operating. This is the Rhone works of the Neuhausen Aluminum Industry Company, in Valois canton.

A New Boiler Feed Water Treatment

Several months ago it was announced in the Australian technical press[1] that a revolutionary method of treating feed water had been discovered in that country. The treatment consisted simply in allowing the water to flow over inclined aluminum plates in the presence of sunlight. Under these conditions the molecular or intermolecular conditions of the scale-forming elements are so changed that instead of forming a hard crystalline scale on the boiler tubes, the deposit is a powdery amorphous mass which can either be washed out of the tubes, or is blown out of the mud drum when blowing down the boiler.

The Australian Apparatus

As used at the Broken Hills Proprietary Company, the apparatus consisted of two aluminum sheets, each 2x4 feet in size, fixed in a frame at an angle of 59 degrees and facing the sun. The water to be used in the boilers was then flowed over these plates from a perforated pipe along their upper edge. As the process was only supposed to be effective during the daytime, storage was provided for the water to be used at night.

In all 197,750 gallons of water were treated and used in a specially cleaned boiler, the test lasting 54 days.

The boiler was then opened, and instead of the hard adherent scale which is normally observed after a run of this length there was either simply a whitish powder or a brittle loose scale, while a portion of the boiler had no deposit in it. The time of cleaning was reduced from 3½ days to eight hours.

American Installations

Several somewhat similar installations have been made in America recently. In these installations, however, a corrugated plate, or a series of aluminum channels has been used. The equipment is being tried by several important industrial organizations; for example, at the Long Island City plant of the Standard Oil Company, and an installation by the West Shore Railroad at Newark, N. Y., the water in this instance being used by the locomotives. These installations have not been in use long enough to give a definite opinion as to the value of the operation, but the important character of these two corporations indicates that the matter may be worth following up.

It may be noted in this connection that the Watson-Stillman Company, of New York, is putting on the market a compound claimed to be a natural mineral product "consisting mainly of iron, alumina and silica," which is fed into the boiler in suitable quantity at each stroke of the feed pump. It seems to be the general assumption that aluminum hydroxide is partly responsible for the results obtained, as suggested under the idea of protective colloid below.

On Feb. 24, 1911, Thomas R. Duggan, of London, lectured on this new process before the Society of Chemical Industry, adding somewhat to the information already made public. The form of the apparatus shown was that with corrugated aluminum plates, but the corrugations are apparently more to insure thorough distribution of the water than for any other reason. There is a hopper at the top, from which a number of small nozzles, one to each trough, feed the water to the plate. The hopper is furthermore provided with a screen to keep large pieces of dirt and grit from choking the nozzles.

The plates should be open to the air, and although more active by day, have some activity at night, apparently due to the small amount of ultraviolet radiation even at that time. The plates in the northern hemisphere should face south; in the southern hemisphere, north. It is essential that the pipes and storage tanks used after the water is treated should be, as far as possible, of nonconducting material, and the water should be used as soon as possible after treatment, and should be used by the seventh day, as a maximum. It is also essential that the plates should be given a rest occasionally; where hard water is being treated, every plate is allowed to rest one day per week.

It is stated that the plates become positively charged, and the water negatively, and this, when considered in conjunction with the fact that the plates should face either north or south, and that a nonconducting material should be used for the storage tank, leads to the belief that some fundamental change in ionization is responsible for the results. However, a minute amount of the aluminum dissolves, and researches with the ultra-microscope show that it remains in colloidal solution, though whether as a mixture of aluminum and aluminum hydrate, or the latter only, seems open to question. Whichever of these it may be, the explanation of protective colloids seems also possible.

The apparatus is made in units about 6 inches wide, one 6-inch unit having a capacity of about 1000 gallons per hour. The advantages claimed for the treatment are: It is automatic, continuous and uniform; no chemicals or heat used, hence low treatment cost; it has no action itself on the boiler, and by a deoxidizing effect on the water is a preventer of corrosion; hard scale is prevented and the time of cleaning the boiler much lessened, thereby getting more hours' work from a given plant; by the elimination of hard scale the efficiency and life of the boiler are claimed to be increased.

Any water is amenable to this treat-

[1] *Aust. Min. Std.*, Sept. 21, 1910.

ment except that containing ferrous sulphate or carbonate. With saline waters the length of the plates is increased beyond the usual 5 feet, or the water run back over the plates several times. Boilers under this treatment must be blown off frequently, particularly during early stages, as old scale often loosens and settles into the mud drum during the first few weeks.

The process is the invention of Herr Brandes, and is patented in most civilized countries, the rights for the United States being held by the Luminator Water Company of America, with officers in New York.

Proposed Western Coal Combination

INDIANAPOLIS CORRESPONDENCE

Every coal mine situated in the Central and Southwest competitive field has taken steps toward a combination for self-protection and the conservation of its resources, despite the existence of the Sherman anti-trust law and the stringent laws against such combinations in the various States in which the mines are located.

It is planned ultimately to take in every mine not controlled by a railroad company and a start is being made in the central southwest States because in these districts the operators already have a fairly good working agreement under what is known as the Joint Interstate Conference, the main object of which is to arrange wage-scale agreements with the miners. The principal States included in this conference in force are Indiana, western Pennsylvania, Ohio, Illinois, Missouri, Kansas, Texas and Oklahoma.

The principal arguments that are being used to induce the operators to come into the combination are conservation of resources and an attendant increase in the price of coal to railroad companies and other large steam producers.

HIGHER PRICES FOR RAILROAD COAL

With these mines as a nucleus the railroads can be forced to pay higher prices for their coal and make it possible for the mines to operate on a more conservative basis without reducing the wages of the miners; in fact, it is planned to promise the men a substantial increase in case of success. Full credit is being taken by the leaders in the movement for an improvement in the present methods of mining coal which are declared to be wasteful in the extreme and made necessary by the rush of competition and demands for hasty shipments. It is pointed out that in some localities more than 40 per cent. of the coal blasted is never taken out of the mine and will continue to lie useless until such time as the coal seams run out and the companies will be obliged to go back over the old ground and take out the coal which now is being left behind.

It is contended that with the combination in full working order the great rush of competition will be cut down and the railroads and other large steam producers, instead of naming the price of the coal they buy, as is now the case, will be obliged to pay a reasonable price, including a fair profit to the operators. The claim is made that the railroads are buying coal as low as $1.25 per ton, while the cost of mining is more than 90c., to say nothing of the dead work and outside expenses.

PRESENT METHODS WASTEFUL

Competition has grown so great in the coalfields that operators cannot afford to mine economically. The coal is shot down in many instances from the solid. This is declared a most wasteful method and the old method of undercutting is declared more than ever desirable. This method has been discarded in many of the mining districts and machine mining has taken its place. Under the machine-mining conditions, it is said efficiency vanishes and any man may work as a miner, skill being negligible and as a result the mining towns have come to be a congregating place for inefficients who have failed in other lines of work, but who know enough to drill a hole with a machine, put in a blast of powder and touch an electric button to fire it. The old experienced miner who knew mining from the beginning to the finish and never engaged in any other pursuit, is fast dying out. A new element is taking his place and with the new element the difficulties of the operator and of the miner himself are said to increase.

That the overproduction of coal is the cause of the vastly reduced price to the railroads appears plain. The statistics of the mining industry over the country show the average miner rarely works 200 days in the year.

The leaders of the present movement argue that with a reasonable restriction of competition they can force the big coal consumers to pay a better price for their coal and at the same time can reduce the price of coal to the domestic consumer. It is asserted that the increase in domestic coal during the last few years has been made absolutely necessary because of the steady refusal of the railroads to pay a fair price.

Chief among the obstacles in the way of this movement is the Sherman anti-trust law, the stringent laws against combination in the various States and the lack of real leaders who will for a time forget their own immediate and individual interests for the benefit of all.

The conditions in the coal industry are such that the movement to combine and force the railroads, steamship lines of the East and others to pay a higher price for the product is meeting with favor. The success or failure of the proposed organization of coal mines will largely depend on the men selected to head it and the means which are employed to surmount the obstacles presented by the law. At least that is the belief of prominent operators in the central States.

British Columbia Copper Company

In the annual report of the British Columbia Copper Company for the fiscal year ended Nov. 30, 1910, the general manager states that the year opened with unsettled labor conditions. A demand was made by the Western Federation of Miners that all nonunion employees be discharged or compelled to join the organization. Arbitration under the "Industrial Disputes Investigation Act" resulted in a decision in favor of the company, but a strike was begun April 19, lasting until May 11; it was not until July, however, that normal conditions were reëstablished.

A controlling interest in the New Dominion Copper Company, Ltd., was acquired; the Wellington Camp claims were fully paid for and development work showed them to possess greater value than was originally estimated; the aërial tram from the Lone Star mine will be in service about March 1, 1911, and the cyanide plant at the Napoleon mine in Washington will be completed about the same time. Two of the furnaces at the smeltery have been reconstructed, increasing the capacity 50 per cent., in order to treat the increased tonnage that will come from the Lone Star, Wellington Camp and New Dominion mines. The improvements have been paid for out of net revenue.

The Canadian Pacific Railway extension is expected to reach the Nicola Valley coal mines during 1911, and a spur has already been completed to the Wellington Camp mines.

The mine shipments during the last year amounted to 400,224 tons. The furnaces smelted 441,672 tons of ore and converter slag from which 7,199,034 lb. of blister copper were produced, containing 7,143,456 lb. copper, 24,962 oz. gold and 84,180 oz. silver.

After deducting the receipts from gold and silver contents, the cost of producing copper was 9.048c. per lb., or 0.781c. less than for the preceding year. The yield of copper was 18 lb. per ton, and $1.23 per ton was realized from gold and silver. The average price received for copper was 12.778c. per pound, as compared with 13.08c. during 1909.

The proceeds from metal shipments totaled $1,466,749; the total expenditures $1,210,188, leaving a balance of $256,561 which, added to the balance of 1909, $474,704, left the total balance $731,265 at the end of last year.

Mining Operations in Peru in 1910

By F. E. Ross *

Mining industry prospering. Ferrobamba, a copper property in southern Peru, the largest new flotation. Important hydraulic operations at Poto and Aporoma mines in the Sandia district.

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It would be unfair to comment upon the mining situation in Peru without making reference to general conditions insofar as these affect the mineral industries. First, then, as to the political situation. This is comparable to that of the United States in that the party in power is split into two factions: one, the administration; the other, the "block." These correspond roughly to the "stand-patters" and the "insurgents" of the United States, and the effect on legislative business is similar, although there is no indication here of the ultimate result of the internal dissension being the success of the opposition party.

Leaving politics and speaking of financial conditions, the country has not entirely recovered from the effect upon the outside world of the disturbances of May, 1909, although the Government then held and now holds the situation well in hand. Recent despatches published in European and American papers which have reached Lima show that the press bureaus in Chile are actively disseminating news of revolutions in this country, with the purpose of injuring its credit abroad. There have been slight disturbances in the interior, the most serious being the robbing of the Central Railway pay car of £1130 in December, but even in that case the culprits were behind the bars in six days and the money recovered the next week. All this, however, slight as have been the deflections from perfect order in comparison with those in other and often older countries, has shaken confidence and caused a disposition to withhold investment in new undertakings.

The administration of Peru is a sound, business administration. The president is a successful business man, and the Government gives every guarantee of peace and order. With regard to foreign relations, Peru promptly accepted the suggestion of the United States, Brazil and Argentina to submit the boundary differences with Ecuador to the Hague, and the disinclination of Ecuador and Chile to follow the obvious course and come to an agreement with Peru is rapidly alienating from those countries all sympathy of the responsible republics of both continents, as shown by recent governmental acts and the tone of the Argentine, Brazilian and English press, as well as of that section of the press of the United States which does not get its Peruvian news from Santiago and Valparaiso.

THE CERRO DE PASCO SMELTERY AT LA FUNDICION, PERU

MINING DEVELOPMENTS OF 1910

Among the most notable mining developments for the year was the Ferrobamba, Ltd., floated in London with a capital of £120,000 to open up large bodies of high-grade copper ores in the south of Peru, and promptly taken under option by A. C. Burrage, of Boston, who has contracted to form a £1,400,000 company to develop the properties, build railway connections, etc. Tests are going on with drills at present, and the manager, W. E. Gordon Firebrace, has gone to London on consultation. Frank Klepetko has been engaged by Mr. Burrage to make a metallurgical examination and is at present at the property.

APOROMA, LTD., SOON TO OPERATE

The Aporoma Goldfields, Ltd., of London, are rapidly installing a large hydraulic and electric plant on their placer property in the Sandia district. G. Allen Crane, engineer and manager, expects to have the first "giant" in operation by May or June of this year. This company will not be hampered by any lack of funds. The Poto placer mines, a little farther up in the mountains in the same district, propose increasing their four monitors to 15 during the current year. This is an Argentine company, Mr. Ingolsby being manager. There are strong rumors of something being done shortly with the wonderfully rich Nusiniscato River gold deposits belonging to the Vannoni interests, which will involve transportation developments of some magnitude as a preliminary step.

Fernando C. Fuchs has lately returned from the Montebello Orco mines, where he has installed a three-stamp equipment, which is paying its way while aiding further development of this promising property. Nearby, the Inca Mining Company is steadily at work on the Santo Domingo mines, where it has a heavy investment.

Important tungsten-ore discoveries are reported from Ancachs and the Canta region, but developments are not extensive, and general secrecy is maintained.

Activity at the Smelteries

The Cerro de Pasco Mining Company twice made new records in the production of copper bullion during 1910, producing 4,926,217 lb. in October and 5,175,000 lb. in December. They are erecting several McDougal roasters for preparation of fine ore for the reverberatory furnaces, and carrying out a number of significant improvements at the smeltery. At the mines they are preparing to do part of their underground haulage by electricity, the first installation in Peru. The administration of A. B. W. Hodges, the new general manager, has opened auspiciously.

Backus & Johnston are erecting some new roasting pots of Lima manufacture at their Casapalca smeltery, with necessary bins, blowers and motors. Since Mr. Johnston took direct charge of this plant, the improvements have been continuous, being amply justified by the increased and steady output. Rumors have been flying about regarding the consolidation of the Casapalca and Rio Blanco smelteries, and these persist in spite of denials. For more than a year the Rio Blanco smeltery has not been in operation, having been run but a short time previous to that.

At the Fernandini smeltery Rizo Patrón, the engineer in charge, is erecting a new stack of slag brick, which will allow starting the second furnace. He is also testing out a slime filter of his own design. Near Cerro de Pasco, Fritz and Ralph Mella are experimenting with the cyanide process on old silver tailings. Nicanor García y Lastres has also been treating gold and silver ores from different camps with a view to commercial cyanide installations, for which he has submitted proposals.

The scope of this article will not permit even mention of dozens of new mines in prospecting or early development stages in the Canta, Huancavelica and other districts, some of which are engaging the attention of engineers of prominence and absorbing considerable amounts of capital and mechanical equipment.

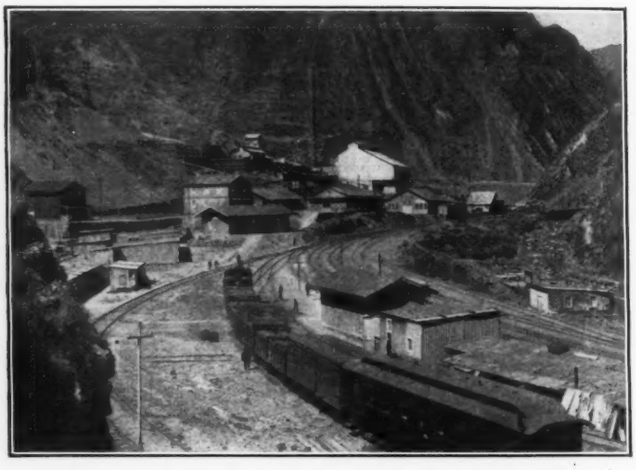
Petroleum and Coal

In the petroleum fields of Zorritos, Lobitos and Negritos-Talara, all in the north of Peru, the output has increased during 1910, owing largely to the policy of sinking deep wells into the lower sands, which have proved generally self-flowing. At Zorritos the kerosene refinery has been enlarged to a capacity of 150,000 gal. per month. Peruvian petroleum possesses characteristics which place it in the front rank in respect of the lighter distillates, and ahead of all save Russian oils as a lubricant. The output is mainly consumed in Peru, the residue going to the nitrate *oficinas* of Chile for fuel.

The coal-mining situation is so linked with the railways that, aside from the continued development of the Goyllarisquisga and Quishuarcancha mines of the Cerro de Pasco company for their own purposes, there is little to be said. Coal of good quality has been discovered in widely separated districts, amply providing for the future needs of the country. At present the failure of the Chimbote-Recuay Railway Company to complete the line under its concession leaves the Yuramarca field, the most accessible to the coast, still undeveloped. The Government must soon take action in this matter, and perhaps the Peruvian Corporation will be given an opportunity to complete the line, the first 57 km. of which from the coast it already operates.

Railroad Developments

The Southern Railways now extend to Cuzco on the north, giving several new points of departure for the Madre de Dios and southern *montaña* country, and the Peruvian Corporation (which operates the Southern and Central railway systems) this year bought the Guaqui-La Paz railway, with the steamers on Lake Titicaca, so that there is now a through service over the Southern from Mollendo via Arequipa and Puno to La Paz, Bolivia, and a weekly saloon-car express in connection with the direct Transatlantic steamers of the Royal Mail to Lima. Under government order, the Peruvian Corporation is now surveying a line from the Cuzco division to the Madre de Dios river, and has also undertaken to build a new harbor in the Bay of Matarani, 12 km. north of Mollendo, with rail connection to the main line between Mollendo and Arequipa. This will reduce the distance, and give a protected, deep-water harbor, that of Mollendo being dangerous in some weathers.



The Smelting Plants at Casapalca and Rio Blanco, Peru

The Central Railway has completed the Huancayo extension, and the Government is building on from Huancayo toward Cuzco on the Southern, a link in the Pan-American Railway, to which the completion of the Chimbote-Recuay railway will also contribute. This will leave only a short link between the end of the Cerro de Pasco railway and Huaraz to complete this important undertaking from Bolivia in the south to within 280 miles of the Ecuador boundary.

The Chamber of Deputies has voted for the construction of the Ucayali railway, promoted by A. W. McCune, to connect the Ucayali river with Lima and Callao via the Cerro de Pasco and Central lines; but as the measure has yet to pass the senate, the strong opposition to its provision for a 5 per cent. gradient and a narrow-gage link in the otherwise standard-gage lines may defeat it.

The house of Arthur Koppel, of Berlin, has completed the preliminary survey ordered by the Government for the Paita-Marañón railway, and is now carrying

out the order for the survey of the Oroya-Tarma-Port Werthman railway from the Central at Oroya to the Ucayali river, making the fourth line under serious consideration by the Government from the coast or a connection with the coast to the navigable headwaters of the Amazon river in Peru, one utilizing the Southern railway, two the Central, and the fourth building to the coast at Paita. At least two of these will be undertaken during 1911. The railway reports for 1910 show a slight falling off in freight receipts over 1909, and a material increase in passenger receipts. The Peruvian Steamship Company, which started 1910 with two 18-knot steamers in the Callao-Panama service, will have five on the run as far south as Mollendo by August, 1911.

The influence of the Panama canal is being strongly felt in advance in Peru, which from its position must receive the first and most lasting benefits from its opening. A proposal was launched at the Panama meeting of the American Institute of Mining Engineers for the holding of the 1914 or 1915 meeting in Peru, with the attractions of the highest smeltery at Cerro de Pasco, the highest railway line and many engineering, metallurgical and climatic wonders to interest that scientific body.

Market Value of Manganese Ores

The principal oxidized ores of manganese are psilomelane, 49 to 62 per cent. Mn; and pyrolusite, containing up to 63 per cent. Mn. The carbonate, rhodochrosite, equivalent to 61.72 per cent. MnO_2, and the silicate, rhodonite, equivalent to 54.15 per cent. MnO_2, are possible sources of manganese. It should be noted, however, that in an ore intended for blast-furnace use, such of the manganese as is chemically combined with silica is not only useless, but is actually a detriment on account of the increased amount of manganiferous slag produced. Inasmuch as manganese ores are not consumed for the purpose of extracting metallic manganese, but as a means of adding manganese to pig iron, by making ferromanganese, any elements that would be objectionable in an iron ore are also detrimental in a manganese ore. Because of the large quantities of high-grade manganese ores obtainable in Russia, India and Brazil, the buyers' requirements have steadily advanced, until now ores averaging from 50 to 60 per cent. manganese are not at all uncommon. In *Zeitschrift für angewandte Chemie*, Nov. 25, 1910, A. Rzehulka discussed briefly the marketing of manganese ores.

In the last 10 years Russia has produced about 40 per cent. of the total amount of manganese ore mined in the world. Its annual production is about 550,000 long tons, of which about ⅕ comes from Nikopol, in southern Russia, and about ⅘ from the Caucasus. About ¼ of the total production is consumed in Russia, and of this consumption about 75 per cent. comes from Nikopol, so that nearly the entire output of the Caucasus is exported. The principal competitors of Russia in the world's market are India and Brazil; the largest consumer of manganese ore is the United States, followed by Germany and England. In the American market, Russian ore has now almost disappeared, and in the other markets also the consumption of manganese ores mined elsewhere than in Russia is steadily growing. Consumption in England and Germany has increased exceedingly in recent years, with the result that exports from Russia to these two countries has nearly doubled; and yet, whereas up to 1907 about 46 per cent. of the English imports and 72 per cent. of the German imports came from Russia, in that year Russia provided only 24 per cent. of the manganese ore consumed in England, and only 50 per cent. of that consumed in Germany.

General American Requirements on Impurities

In the American market, the basic requirements for manganese ore are that it shall not contain more than 0.20 per cent. phosphorus, nor more than 8 per cent. silica,[1] for each 0.02 per cent. phosphorus in excess of 0.20 per cent., 2c. per unit of manganese is deducted per ton, and for each 1 per cent. of silica in excess of 8 per cent., 15c. per ton is deducted. The base price fluctuates according to the manganese contents, as follows: 49 per cent. and over, 26c. per unit; 46 to 49 per cent., 25c. per unit; 43 to 46 per cent., 24c. per unit; 40 to 43 per cent., 23c. per unit.

German Foreign Ore Terms

Russian manganese ore is bought in Germany, on the basis of 50 per cent. manganese, at 1.10 marks per unit, with 1 mark added or deducted for each 1 per cent. above or below the basis; the sample is dried at 100 deg. C. The maximum limit for phosphorus is 0.15 per cent., and for silica 9 per cent. The price for Russian ore in all European ports ranges from 0.65 to 1.30 marks per unit of manganese, with deductions of 35 to 40 pfennig per ton for each per cent. of silica over 9 per cent.; deductions vary for excess of phosphorus above the allowable limit. With Turkish manganese ores, the basis is 45 per cent. manganese, with not more than 0.03 per cent. phosphorus, nor more than 10 per cent. silica, and the price is about 95 pfennig per unit, or somewhat higher for ores of better grade; deductions for silica and phosphorus are subjects of negotiation.

Japanese ores are sold at Hamburg on the following schedule, in marks per ton on the basis of contents of manganese dioxide: 87 per cent. and above, 115 marks per ton; 85-90 per cent. (minimum 85), 95 marks per ton; 80 per cent., 85 marks per ton; 70-75 per cent., 75 marks per ton; 65-70 per cent., 50 marks per ton.

These Japanese ores average from 44 to 56 per cent. manganese, phosphorus is about 0.5 per cent. and silica 7 to 10 per cent. They go by the name of Japanese brownstone, and bring a high price on account of their purity.

German Domestic Ore Terms

German manganese ores sell at the mine, on the basis of 50 per cent. manganese dioxide, at about 20 marks per ton, equivalent to 40 pfennig per unit of dioxide; for each unit of dioxide above or below 50 per cent., about 1 pfennig added or deducted.

The annual production of manganese ores in the world is subject to wide fluctuations, as a result, partly, of political disturbances in the principal producing countries; it is also directly influenced by the condition of the iron industry, which consumes by far the largest part of the manganese ore produced in the world.

The consumption of manganese ores in Germany is about 250,000 tons per year, of which only about 50,000 tons are produced in that country. The most convenient source of supply for the extra 200,000 tons is the Caucasus district, but on account of the political uneasiness in Russia it is becoming an interesting problem to arrange for future supplies obtainable with regularity.

[1] *The Mineral Industry* for 1909, Vol. XVIII.

Extraction of Borax

G. E. Bailey and A. Stevenson, of Los Angeles, have patented a process (German Pat. No. 223,025) for extracting, or manufacturing, borax from its natural mineral compounds. The process is applicable to any mineral or combination of boron with a base that forms insoluble sulphates, such as colemanite (calcium borate), ulexite (sodium-calcium borate) etc. It consists in roasting the crude mineral with sodium sulphate, whereby sodium borate and calcium sulphate are formed. The former is leached out of the latter by hot water, which is then cooled to 0 deg. C, and the crystallized borax recovered.

American engineers are reported by Consul A. T. Haeberle to be engaged, on behalf of an American iron and steel company, in the examination of the famous iron mountain of Agalteca, 48 miles northwest of Tegucigalpa in Honduras.

Notes on Mine Sampling

By Glenn Anderson *

This article describes in detail, the methods of sampling employed underground, tools required, crushing of the samples, their preparation for assay and recording of results.

*Manager, King Edward Silver mines, Cobalt, Ont.

In presenting the following article no particular originality is claimed, as the subjects treated are not new. The notes were written mainly to group together and crystallize a lot of scattered memoranda and forms, mainly for the use of assistant samplers in order to avoid repetition of the subject matter to new men and to gain uniformity in work. From time to time the notes were amplified to present the matter in its larger aspects. As there are few sources of information—outside of actual experience—on the mechanical part of sampling, open to the beginner, the article is submitted in the hope that it may be of interest to the younger members of the profession. The subject divides itself naturally into two parts: (1, Sampling deposits exposed by underground workings. (2) Sampling by drilling, test pits or trenches on the surface. The first topic will be mainly considered here.

Sampling Equipment

The tools necessary for sampling are: hammers, moils, picks, brooms, sample catchers, sample sacks, tapes, surveying instruments, canvas sheet, oilcloth, shovels, automatic sample reducers, crushers, bucking board, etc. Moils, picks, shovels and hammers will usually be found at the mine and frequently also surveying instruments and complete assay office. This matter must be determined before setting out and nothing left to chance. The hammer for average rock should be from 3½ to 4 pounds in weight; for very hard rock an 8-lb. double-jack may be necessary and two men be required to cut the sample—one to strike, the other to hold the moil. Moils should be made in various lengths from 8 to 18 in. of ¾- or ⅞-in. steel with pyramidal points. In some cases, especially in hard rock, moils with handles (Fig. 1) are very useful as the striker can put more force into his blow without fear of injuring his partner.

Picks are used for taking the sample in very soft or sugary rock; the ordinary geologists' pick is best for this work Large picks of ordinary mine pattern are used to dress and square the back before sampling.

Steel or corn whisk brooms are essential to remove from the face all dust and fines that are usually rich and may salt the sample. Several long-handled brooms should be included in the outfit to be used in sweeping up fines when cutting down large samples.

Sample catchers are of various kinds. A tight powder box is fairly good if the rock is not so soft or loose that outside chunks jar loose and fall into the sample. A canvas funnel suspended from an iron frame is light and convenient. (Fig. 1.) For very hard rock where chips fly wide, a roll of canvas four to five feet wide and 10 ft. long is spread on the bottom of the drift or on planks in stopes so all cuttings are easily caught. Much care should be used in picking down before the sample is taken, as loose lumps will otherwise jar loose and fall into the sample. The cloth must not be allowed to become wet and must be carefully beaten after each sample is taken.

Sample sacks will vary in size according to the width of vein and the size of sample desired. Usually canvas concentrate sacks will be found best for general use. Each sack should have a string sewed through the neck so that it will not be lost. Many engineers have numbers stenciled on the sacks, but this is somewhat risky if there is any danger of tampering with the samples. If samples are to be taken out for assay, they will usually be cut down and placed in heavy paperpulp-sacks flitted with a metal closing device, such as are used at a smeltery.

Good Mine Maps a Great Help

Each man in charge of a sampling gang should be provided with a steel tape, 25 to 50 ft. in length, for measuring the widths of cuts, distances from stations, etc., a compass and clinometer for taking dips and strikes of faults, dikes and cross fissures, and a good notebook with cross-section pages. If the mine maps can be relied upon, the only instruments necessary will be tapes and Brunton compass. If the mine maps are not complete or are uncertain a transit should be included, also several hundred feet of No. 20 copper wire for plumbing shafts. When the samples are to be cut down at the mine, some form of crusher is almost essential. For this work the small laboratory crusher is of little use; the best type is a small Blake or Dodge which can be set up either coarse or fine; for finishing, a bucking board does very well. In reducing the mine samples, some form of sample cutter is to be preferred over the coning and quartering method. The Jones type is the best portable device or the split shovel is good. Several pieces of best quality white oilcloth will be necessary for mixing and rolling.

Preliminary Work

While the assistants are checking up and making surveys and working maps of the property, the head engineer should make a preliminary inspection, taking character samples of the different classes of ore; noting the geology, vein formation, shape and character of orebodies, and general conditions. He should get all possible information about the history of the district, records of neighboring mines, changes of the ore in depth, such as influence of water level, secondary enrichment, etc.

Sample Maps

Unless the mine maps are to be relied upon absolutely, a complete survey is necessary. In any case the working

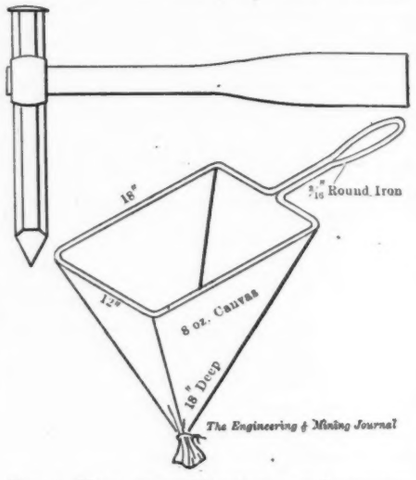


Fig. 1. Moil with Handle and Sampling Bag

stopes must be measured and a longitudinal projection or development of all veins be made. It will usually be necessary to make a development, as otherwise the orebodies will not show in their true dimensions. In making the development, the differences in hight between levels at different raises are usually neglected, as the distances are short and do not vary widely from those obtained by assuming straight lines from level to level on the dip of the vein.

The longitudinal distances are usually more variable and must be taken into account. Fig. 2 shows a transverse section of mine workings and Fig. 3 shows the same mine in plan.

The development is constructed as follows: The true distances, *a—b, b—c, c—d*, etc. (Fig. 2), taken as the distances between levels, are laid off on the development sheet and levels are drawn in parallel straight lines, no allowance be-

ing made for grade. A center line as *x*—*y* (Fig. 3) is assumed and the distances 1—2, 2—3, 3—4,....8—9, 9—10, etc., being the distances between survey stations, are pricked off on the map. This shows the true length of all drifts on the development map. All raises, winzes etc., are located at their true distances from the center line. Fig. 4 shows the longitudinal map constructed as described above. Raises which are in parallel vertical planes will not show parallel on this map as the drifts on different levels are not of the same lengths between raises due to rolls in the vein. All raises, winzes and other workings should be numbered or lettered and likewise each block of ore should be designated by letter or number. A similar long development should be made for each ore-bearing vein.

Taking Samples

The sampling interval, or distance between adjacent samples, depends on various factors. It is well to start with a long interval, say 10 ft. at first; then if the distribution is not uniform a resample at the intermediate five-foot points may be taken. In some cases a 2½-ft. interval may become necessary. The positions for sample cuts are measured from a single point (preferably a survey station) and are marked with whitewash, tags giving location, or in any other way which may suggest itself. The marking should not precede the sampling by a long period as this allows too much opportunity for salting.

Prepare the back by picking down all loose and projecting rock. If possible, dress down so that the vein section is a straight line normal to the dip. In many cases the ore extends down the sides of the drift and presents an elongated section which may give an undue portion for this part of the sample and vitiate the results. The more nearly the sample cut is taken normal to the dip in a straight line, the less will be the chance of error. In some cases it is impossible to get a normal section, and the only alternative is to take less material from the parts so exposed. In soft ore, several inches of the back should be removed to guard against salting, which may occur either intentionally or by rich ore being blasted in during the course of the work.

The Size of Samples

After the face has been dressed down it should be brushed carefully to remove all dust and loose particles. Next, with the point of the candlestick or the candle itself, mark off the sides of the groove which is to be cut. The size of the cut depends much upon the ideas of the sampler and the hardness of the rock. Most engineers try to cut a groove from four to six inches wide and one inch deep. Such a cut will furnish from four to seven pounds of sample per foot of width in quartz. The utmost care should be used in keeping the sample uniform and many engineers insist that a resample be made on all cuts that vary more than 10 per cent. by weight from the average. This is a hard matter to decide, as the weight of the ore itself is variable, especially in sulphide bodies; but the size of the groove should be made uniform throughout the work.

Sampling Streaks or Bands

When the ore exposure shows streaks or bands, these should be sampled separately, as the distribution of the valuable mineral is usually affected and can be shown on maps. In wide orebodies sectional cuts should be taken, of widths of four or five feet. As far as possible, take samples as the ore would be mined. For example, if a vein consisted of two feet of sugar quartz with one foot of soft barren oxidized material on one wall, the latter would necessarily be sampled and included, as it would inevitably become mixed when stoped. In difficult places it pays to rig up a strong, safe staging, rather than try to work from a ladder or other inconvenient place.

Each sample is marked with a metal, wooden or paper tag placed in the sack. Metal tags with numbers punched or cut in are best, as they are not affected by moisture or heat in drying samples. Special knots or sealing wax are used when tying up the sacks so that the sample cannot be tampered with. A sample should never be allowed out of sight of a trusted employee until it is securely locked in a safe place. If more than one gang of samplers are at work they should alternate so that they do not take adjacent samples. All cross fissures should be sampled and wall rock taken at frequent intervals, as values often extend beyond the vein; also blanks should be made up frequently to guard against salting.

Taking Notes

Notes should be detailed and clear. It is impossible to get too much information and nothing should be left to memory. A useful form of notes is shown in Fig. 5. Under "General Remarks" note every unusual occurrence of ore, wall rock, cross fissures or changes in geology. It is desirable to note character of ore, whether oxidized or base, as different classes will require different treatment. In taking portional samples, i.e., two or more samples of different streaks at the same section, it is best to give them the same index number with a letter suffix, as 15*a*, 15*b*, 15*c*, and to always start from the same point as foot-wall or hanging-wall, for section *a*. Always make sketch of vein at these points as shown in Fig. 5. A long section of the level being sampled should be sketched in the back of the notebook and each sample should be marked there when taken to avoid possible mistakes in writing distances from the datum point. If the orebody is of less than stoping width, notice particularly whether or not it could be stripped and mined clean.

The head engineer should resample from 5 to 10 per cent. of all cuts; the assays should agree fairly well with previous samples unless the ore is spotty. Several blanks should be included with each day's lot.

Preparing Samples for Assay

The responsibility of the engineer does not end when the samples are delivered to the assayer. In many cases the custom assayer requires as much supervision in preparing samples for assay as does a green man. At a mine with a well equipped assay office, the cutting down of samples is comparatively easy, but in many cases the equipment is not all that could be desired and it frequently happens, especially at small mines, that there is no crushing machinery at all. In the latter case the task of breaking up a large sample of hard rock is an arduous one. The following are some of the methods for crushing and breaking up the large pieces:

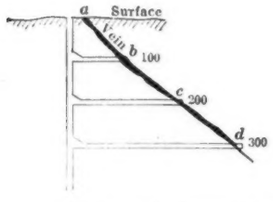


Fig. 2. Transverse Section

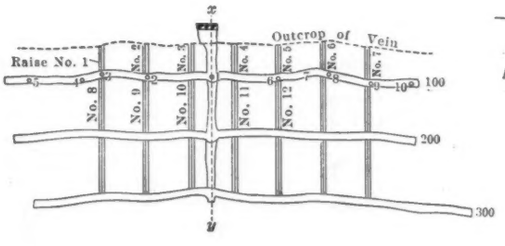


Fig. 3. Mine Plan

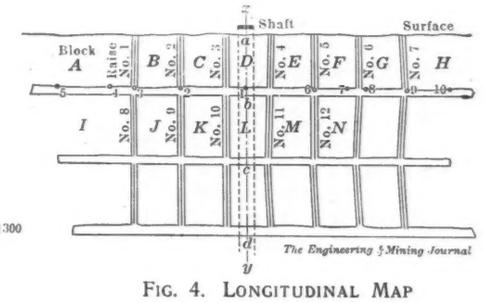


Fig. 4. Longitudinal Map

(1) With hammers. The large pieces are cracked by hand, using a heavy piece of iron, an old anvil or a stamp die for a bottom block. As the rock chips fly badly, it is necessary to have a tight floor, preferably an iron plate or turn sheet or canvas cloth upon which the anvil is placed. Around the anvil and workmen should be placed a light wooden shield, 3 ft. high and 3 ft. square, to retain the flying chips. A cylindrical iron ring of suitable size, placed around the rock to be broken, may answer fairly well to prevent pieces from flying off.

(2) An old piece of shafting can be raised and dropped end on, like a stamp. This method also requires something to stop the flying fragments and any of the devices mentioned in the first case may be utilized.

(3) With crushers.

The final grinding is done on bucking board or power sample grinder.

Cutting Down Samples

This is one of the most difficult parts of the whole process and should have the personal attention of a trained and trusted man. Too often this matter is left to a custom assayer whose sole aim is to run the samples through as fast as possible, with little attention to the cutting down. Often at customs offices, the quartering down and grinding are done by a helper with no careful training. The relation of the size of the largest lumps to the weight of the sample is an important point, depending largely upon the grade of ore and the distribution of the valuable mineral. In general a sample of 30 lb. should all be reduced to ¼ in. before the first cut. The following is a good rule to observe on most ores: 30 lb. crushed to ¼ in., reduced to 15 lb.; 15 lb. crushed to ⅛ in., reduced to 7½ lb.; 7½ lb. ground to 20-mesh, reduced to 3¾ lb.; 3¾ lb. ground to 40-mesh, reduced to 2 lb.; 2 lb. ground to 80-mesh or finer and divided into three samples for assay.

The samples should be dry before attempting to quarter down, as otherwise some of the rich material may be retained in the sticky, talcy portions and cause enrichments. The following are some of the methods of reducing the size of the sample:

(1) By coning and quartering on floor, canvas sheet or oil cloth. This method is too well known to require description. It requires great care to achieve accurate results.

(2) By use of split shovel or Jones sampler. These samplers are made of tin or galvanized iron and are arranged so that alternate compartments retain portions of the sample, while the intermediate ones reject equal amounts.

(3) To cut down large samples it is usually necessary to shovel the pile, retaining alternate shovelfuls or each third, fourth, fifth or tenth shovelful for the sample. Square-point shovels should be used for this work and great care exercised in sweeping up fines and apportioning them. Coning and quartering may also be used for fairly large samples, and usually follow the alternate-shovel method until the lumps are reduced to sufficiently small size for the sample splitters.

In assaying samples the safest procedure is to cut down samples and send duplicates to different assayers, retaining a third or check sample in case the two do not agree within reasonable limits. In many cases it is desirable to assay samples at the mine as soon as taken. In this case much caution should be used and no one allowed in the assay office except trusted men. Blanks should be run on all fluxes and reagents used.

Salting

The term salting was originally applied to fraudulent enrichment of samples by introducing valuable mineral into the ore faces before the samples were taken or into the sacked samples afterward. This is rarely attempted today, because so many precautions are taken. The best guard against salting is "eternal vigilance." Samples of barren rock should be frequently included; constant surveillance of samples observed; and frequent resamples made, especially of those cuts that run high or in any other way look suspicious.

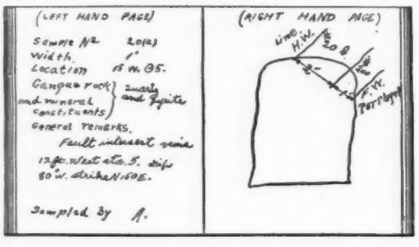


FIG. 5. SPECIMEN PAGE OF NOTEBOOK

Dressed mines are the hardest to guard against, and if there is any doubt, shots should be put in at various points and old drifts cleaned out so they can be examined. Poor showings are often hidden by close timbering, or, in the case of shafts and winzes, by partial filling with muck. Look carefully at timbering which seems unnecessary; crosscuts may be hidden by side lagging filled back. A long bulldozer can be driven in at suspicious places to determine whether the material is solid rock or fill. Fig. 6 shows an actual case of fraudulent covering up of workings, which was published in the JOURNAL some years ago. A winze was sunk in the center of the block of ore which was almost completely stoped out, leaving only a thin pillar on each exposed face. The winze was afterward bulkheaded, filled with muck and the track laid down over it. In a large Western mine a crosscut was driven in a half circle to tap a rich block of ore. This ore was taken out, the crosscut cemented up with concrete, and covered with dirt so as to be indistinguishable from the wall rock.

Unusual Conditions of Sampling

Sampling the bottoms of drifts is a difficult and disagreeable task, but in some cases is unavoidable. The best method is to take up a section of the track, say 100 ft. in length, mucking out clean as the rails recede. A steel push broom may be used for cleaning up the bottom but, if possible, connect a hose of air pipe to a water supply and sluice off clean before cutting the sample. In sampling timbered ground, if the ground will stand, remove all the top lagging from one set; bar down everything loose and take samples in the usual way, being very careful of loose slabs. If in very bad ground, take out one or two poles at a time and replace at once after the cut is taken.

Sample Books and Records

From the notebooks of the sampling squads, the various data are entered on a permanent record sheet, preferably at the close of each day's work, so in case a notebook is lost resampling a large number of cuts will not be necessary. The sample record should be made on tracing cloth so that duplicates can be easily made by blueprinting. The form of this record will vary according to the ideas of the engineer and the class of mine. Fig. 7 shows a useful form.

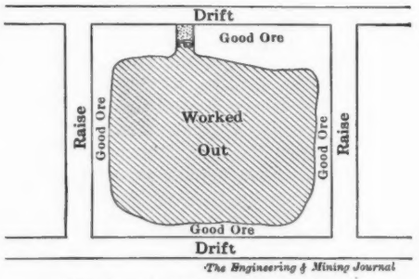


FIG. 6. A FRAUDULENT STOPE

Where the ore is of even grade for some distance, the pulp from a number of cuts may be collected and run as a group sample, the results of which should check fairly well with the calculated average assay for the same group.

From the sample record and the development map, the ore is blocked out and the results entered on the block record (Fig. 7). From the block record the results are entered on the final record (Fig. 7).

As a basis for calculating the tonnage, the weight of the ore per cubic foot should be determined, not guessed. This is done by taking a sample from the rejects of the first quartering for determining its density.

Where there are different classes of ore in a mine, a vein chart is of great value to show the distribution of the different grades and the trend of shoots. This chart is best made on a projection on a plane parallel to the general course of the vein, to show the blocks of ore without distortion. The raises are then drawn in cross-section through the dip, and the drifts in plan so as to show in their true length and positions with respect to the vein. The sample cuts are then plotted in their proper positions on an exaggerated scale of widths two or three times that of the projection, to show more clearly the variations of the ore. The different classes of ore are colored with crayons and lines drawn from level to level to outline the shoots.

Rio Plata Mining Company

The third annual report of the Rio Plata Mining Company in Chihuahua, Mexico, states that 13,969 tons of ore containing 669,000 oz. of silver were mined, from which 17 tons containing 15,429 oz. of silver were sent to the smeltery; 13,952 tons were milled and cyanided in addition to 8159 tons of old tailings, producing 834,862 oz. of silver. The cost per ounce of silver was 18 cents.

The expenditures on improvements amounted to $31,960, of which $17,306 was for development work, the remainder for mill and cyanide machinery. The amount of $12,000 was written off the year's earnings for depreciation of development work, and $8585 was paid to keep the works and machinery up to the proper standard of efficiency.

The present management took charge in January, 1908, at which time the indebtedness of the company amounted to $400,000, all of which has been paid. From the sale of treasury stock, $250,000 was used in completing the mill and other improvements.

The aggregate earnings of the company for two years and eleven months amounted to $608,853, of which $140,072 has been paid in dividends and an earned surplus of $124,746 created. There are 26,336 shares of stock in the treasury. The total earning for the year was $425,556; total expense, $180,493; net profit, $245,062.

Development work amounting to 2163 ft. was done at a cost of $8 per foot.

SAMPLE RECORD.

a	b	c	d	e	f	g	h	i	j	k	k x i	k x j
Sample No.	Sampled by	Location	Remarks on Character of Vein Etc.	Assay: Copper	Assay: Gold $ per Ton	Assay: Silver Ozs. per Ton	Etc.	Copper Lbs. per Ton	Gold & Silver $ per Ton	Width Feet	Copper Ft. x Lbs.	Au. & Ag. Foot x $
1	A	200' L. at sta 1+50'	Heavy Sulphide	6.0	2.00	ag @ 50¢ 10.0		120	7.00	6.0'	720.	42.00
2	B	" " " 1+55'	" "	5.0	2.00	11.00		100	7.50	5.0	500.	37.50
3a	C	" " " 1+60"	Rhodochrosite & Calcospyrite	2.0	1.00	2.0		40	2.00	1.0	40	2.00
3b	"	" " " " "	Heavy Sulphides	6.0	3.00	12.0		120	9.00	4.0	480.	36.00
3c	"	" " " " "	Quartz, iron & copper pyrites	0.25	0.50	0.5		5	0.75	2.0	10	1.50
4	A	Raise 5 to 10' above level	Heavy Sulphide	5.00	2.00	8.00		100	6.00	4.0	400.	24.00
										22.0	2150	143.00
					Averages Samples 1 to 4 inclusive - width 3.67'						av 93.18 lbs per ton	
											av ag. $6.30 per ton.	

BLOCK RECORD.

Block No.	Class	Smelting Ore: Avg. Width	Smelting Ore: Tons in Block	Smelting Ore: Avg. Contents per Ton: Lbs. Copper	Smelting Ore: Avg. Contents per Ton: Au. & Ag. $	Milling Ore: Avg. Width	Milling Ore: Tons in Block	Milling Ore: Avg. Contents: Lbs. Copper	Milling Ore: Avg. Contents: Au. & Ag. $
B	Fully Developed								
U	Probable Ore								
X	Possible Ore								

FINAL RECORD.

Class of Ore	Tons	Avg. Contents per Ton: Lbs. Copper	Avg. Contents per Ton: Au & Ag $	Tot. Contents: Lbs. Copper	Tot. Contents: Au & Ag $	Concentrates: Tot. Tons Recovered	Concentrates: Tot. Contents: Copper	Concentrates: Tot. Contents: Au & Ag $	Gross Value: Cu. at 13¢	Gross Value: Cu. at 14¢	Gross Value: Cu. at 15¢	Total Costs: Mining at $3 per Ton	Total Costs: Milling at $2 per Ton	Total Costs: Smelting	Total Costs: Marketing	Net Value: Cu. at 13¢	Net Value: Cu. at 14¢	Net Value: Cu. at 15¢
(1) Milling Ore	----	Ratio of concentration Total Recovery 80%																
Fully Developed	100000	40	5.00	4000,000	500000.00	10000	3200,000	400000.00										
Probable Ore	300,000																	
Possible "	2,000,000																	
(2) Smelting Ore.																		
Developed Ore																		
Probable "																		
Possible "																		
(3) Total Ore																		
Developed																		
Probable																		
Possible																		

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FIG. 7. FORMS FOR KEEPING RECORDS OF SAMPLES

Several diamonds have recently been found in the glacial gravel at Janesville, Wisconsin.

Types of Canadian Gold Deposits

By Francis Church Lincoln *

The Klondike placers are the principal producers. In the Le Roi and Center Star mines of the Rossland district the lodes are replacements. Saddle reefs are the principal type of gold deposit in Nova Scotia.

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The gold deposits of Canada that have been worked on a commercial scale are the placer deposits of the Klondike district, Yukon; the replacement lodes of Rossland, B. C., and the saddle reefs of Nova Scotia.

The Klondike Placers

The Klondike District[1] is in the western part of Yukon territory, just south of parallel 64, north latitude, and 50 miles east of the Alaskan boundary line. It is bounded by the Klondike river on the north, Wilde valley on the east, the Indian river on the south and the Yukon river on the west. Physiographically, the district is a thoroughly dissected upland with elevations ranging from 1200 ft. above sea level at Dawson in the norththe summit of the dome in the central the summit of the Dome in the central part of the region.

The Klondike area, as bounded above, is roughly rectangular with its longer axis in an east-west direction and contains about 800 square miles.

The first placer mining in the district was conducted on the bars of Indian river in 1894. Bob Henderson found gold on Goldbottom creek in the winter of 1895. While returning from a visit to Henderson, in the summer of 1896, George W. Carmack made his famous discovery of the rich deposits of Bonanza creek which started the extraordinary Klondike rush of 1897-8.

Dawson was founded at the confluence of the Yukon and Klondike rivers and the population of the new camp rapidly rose to 30,000. The White Pass & Yukon Railway was constructed from Skagway at the head of the Lynn canal to a point below the White Horse rapids on the Lewes river, a branch of the Yukon, thus making it possible to reach Dawson from Skagway in 2½ days.

Gold Production

The production of gold rose rapidly, reaching a maximum of $22,275,000 in 1900. In 1907 the production had decreased to $3,150,000; but now, following the installation of machinery, the production is again increasing. The total production from 1896 to 1908, inclusive, is estimated at $225,000,000, and it is estimated that there is $60,000,000 more which can be extracted at a profit.

Climate and Timber

The climate is colder that that of Fairbanks and the annual rainfall less, probably under 10 in. Groves of spruce and poplar alternate with swamps in the valleys, and nearly everywhere the surface is covered with thick moss beneath which the ground is permanently frozen to depths ranging from 60 to 100 ft. The slopes and ridges up to about 3500 ft. above sea level are generally wooded with white and black spruce, balsam-poplar and birch, while stunted spruce occur sparingly at the highest points.

Bed Rock

The bed rock of the Klondike district consists mainly of schists, probably of Cambrian or Pre-Cambrian age. These are intruded by a wide variety of igneous rocks and occasionally capped by outliers of unaltered Tertiary sedimentary rocks.

The oldest rocks are the Nasina series of metamorphosed sedimentaries. They are principally quartzites and quartz-mica schists with occasional bands of crystalline limestone. In places they are associated with chlorite and actinolite schists which are believed to have been basic intrusives. The Nasina series occurs mostly in the northern and southern parts of the district, and has been folded and altered to varying extents in the different exposures.

Klondike Series of Schists

The Klondike series is the most important in the district. It consists of alternating bands of acidic and basic igneous rocks now metamorphosed to light-colored sericite schists and greenish chlorite schists. This series crosses the Klondike district in a zone from 10 to 20 miles wide which strikes in a northwest-southeast direction. Not only is it bounded on the north and south by the Nasina series, but it frequently incloses small irregular areas of those rocks. The Klondike series is foliated throughout, although not equally so in different parts of the district. While a few small folds occur, the beds on the whole have a low dip to the southwest. Unaltered Eocene sedimentaries belonging to the Kenai series occur as outliers in a few places about the margin of the district.

A massive, coarse-grained, grayish granite resembling the Coast granites cuts the Nasina series on the Yukon below Indian river. Smaller intrusions of peridotite, diabase, andesite and rhyolite also occur in the district.

Quartz Veins in Klondike Schists

Quartz veins occur in both Klondike and Nasina schists but are much more abundant in the former. The common type of vein is lenticular and usually but a few inches wide and a few feet long. These veins are much younger than the schists and are believed to have been formed as a result of the intrusion of the granite, just as in the Fairbanks and Nome districts.

Placer Deposits

The Klondike placers constitute a complex deposit including valley gravels, lower-terrace gravels and upper-terrace gravels, ranging in age from recent to Miocene or Pliocene. The upper-terrace gravels were formed by streams when the course of the Klondike river was probably the reverse of its present course. A depression succeeded the period of deposition of these gravels and the Klondike broke into its present valley and deposited a layer of economically unimportant river gravels. Next came an uplift of approximately 700 ft. which gave the streams more cutting power and enabled them to carve valleys through the older gravels into bed rock. During the carving of these valleys, occasional arrests in the process led to the formation of rock benches floored with gold-bearing gravel. The gold in both terrace and valley gravels was derived from the veins and stringers in the schists, mainly by mechanical concentration. The amount of gold per ton which the schists must have contained to produce the gravels has been estimated by Tyrrell. Correcting his estimate to agree with the figures for production given above, the result might have been produced by the concentration of schists containing only 0.019c. in gold per ton of rock.

Creek Valleys Narrow and Deep

A section across the valley of any of the Klondike creeks will show a comparatively narrow trough-like depression from 150 to 300 ft. deep, bordered on one or both sides by wide benches beyond which the surface rises in easy regular slopes to the crests of the ridges.

[1]R. G. McConnell, *Rep.* Geol. Surv. of Canada, No. 687 (1900); R. G. McConnell, *Ann. Rep.* Geol. Surv. of Canada, No. 14 (1905), Part B; R. Beck, W. H. Weed, "The Nature of Ore Deposits" (1905), pp. 638-640; J. B. Tyrrel, *Econ. Geol.* 2 (1907), pp. 343-349; G. A. Young, *Rep.* Geol. Surv. of Canada, No. 1085 (1909), pp. 129-130.

The benches are fragments of old valley bottoms which have been partially destroyed during the formation of the present valleys. Narrow rock-cut terraces occur at intervals between the levels of the old and new valley bottoms, formed during pauses in the cutting of the present valleys. Auriferous gravels occur upon the present valley bottoms and upon the lower and upper terraces which are the remnants of ancient valley bottoms.

White Channel Gravels

The gravels of the upper terraces are known locally as the White Channel gravels. Originally flooring the bottom of ancient streams, they have since been cut through by more recent streams and their present areal distribution is therefore irregular. They vary in thickness from a few feet to 150 ft. and in width from 100 ft. to nearly a mile. Structurally the White Channel gravels are divided into white gravels and yellow gravels. The white gravels are by far the most important because of their higher gold content and wider distribution. They are white, compact gravels composed chiefly of rounded boulders and pebbles of quartz together with a few sericite-schist pebbles in a matrix of sericite scales and fine, angular, quartz grains.

Klondike River Gravels

The White Channel gravels are occasionally overlain by the ancient Klondike river gravels formed during the depression of the region. These gravels have a thickness of from 150 to 175 ft., are composed of material brought from outside the Klondike area, and are only slightly auriferous.

The valley bottoms of the present streams are covered with gravels to a depth of from four to 10 ft. These gravels are overlain with two to 30 ft. or more of black, frozen muck. They are almost entirely of local origin, consisting mainly of schist and other rocks which outcrop along the valleys. They are made up mainly of disk-shaped schist pebbles, associated with quartz pebbles and boulders and less frequently with pebbles of eruptive rocks, in a matrix of coarse reddish sand.

Distribution of Claims

The claims in the Klondike district run for 500 ft. along the creek. The richest claim, No. 17 on Eldorado creek, produced about $1,500,000, or $3000 per running foot of valley; several claims on Eldorado and Bonanza creeks yielded over $2000 per running foot; and the majority of the lower Eldorado claims, a considerable number of the Bonanza claims and a few of the Hunker creek claims ran more than $1000 per foot. The White gravels on Bonanza creek in some cases produced $60 per square yard for entire claims.

The areal distribution of the pay dirt is irregular, depending largely upon the condition of bed rock. When this is soft and smooth, the gold slips across it, to collect where the harder schists form natural riffles. The pay is generally richest in the middle portions of the stream's course. Sometimes it extends across the valley from rim to rim.

The pay streak usually consists in part of the gravel resting upon bed rock and in part of the underlying bed rock itself. Thus on Bonanza creek the pay dirt consists of from four to six feet of gravel and from two to four feet of bed rock; and in the White Channel gravels above this creek the gold is mostly concentrated in the lower three to five feet of gravel and the upper one to two feet of bed rock.

Character of Gold

The gold varies in shape from large angular or crystalline pieces at the heads of the valleys, through smaller rounded pieces to flattened scales at the lower end of the valleys. When crystalline, the gold usually forms bulky octahedral crystals. Sharp dendritic crystals have been found occasionally, indicating that a small amount of solution and deposition of gold has taken place. The largest nugget found weighed 85 ounces.

The fineness of the gold varies on the different creeks from an average of $14.59 on Eureka creek to $17.75 on Allgold creek. The purity of the gold usually rises as the particles of gold become smaller. Thus in going down Hunker creek the value of the gold rises from $15 to $17.25 per ounce.

Many of the gold grains and most of the nuggets inclose quartz, and a few are themselves inclosed in quartz. There occur associated with the gold galena, magnetite, limonite, hornblende, garnet, pyrite, cassiterite, platinum and osmiridium.

The Replacement Lodes of Rossland

Rossland is in southern British Columbia, five miles north of the Washington boundary. Its lodes were discovered in 1890. From 1894 to 1905, inclusive, the camp produced $33,351,536, more than half of which came from the Le Roi mine. This mine has recently ceased producing and the Center Star mine is now the largest producer in the camp.

The mines are in the West Kootenay mining district, at the head of Trail creek, on the south flank of Red mountain. Their average elevation above sea level is 3140 feet.

Geological Features

The oldest rocks in the Rossland district are slates, limestones and quartzites of Mississippian age, with which some tuffs and lava flows are interstratified. Into these rocks have been intruded successively augite-diorite porphyry, monzonite and grano-diorite, ranging in age from Upper Mesozoic to Lower Tertiary. The eruptive activities were brought to a close by the intrusion, during later Tertiary time, of mica-lamprophyre dikes of uncertain age.

Rossland Ore Deposits

The ore deposits consist mainly of replacement lodes[2] formed along zones of shearing. Fissure veins, with or without replacement, and irregular impregnations of the country rock also occur in the district but are of minor importance. The lodes were formed in Tertiary time by hot, ascending waters which found their way into the narrow fissures of the shear zones, probably just subsequent to the intrusion of the mica-lamprophyre dikes. With the exception of these dikes, the lodes occur in all the country rocks, but the augite-diorite porphyry and the monzonite are especially favorable to their occurrence.

Le Roi-Center Star Lode

The mineralization is highly centralized, the ore having almost all come from an area of 100 acres. Within this area the lodes all have a northerly dip. The Le Roi-Center Star lode strikes north 60 deg. east and dips northwesterly 70 deg. The Josie is a parallel lode. The other lodes are branches of the Le Roi-Center Star and have northwesterly strikes and northeasterly dips. The mica-lamprophyre dikes are numerous and all have a northerly strike and nearly vertical dip. They vary in width from a few feet to 250 ft. The larger dikes cut the lodes, but occasionally the smaller ones are cut by the lodes. Normal faults, nearly parallel to the dikes, also displace the lodes. That the lodes were mineralized subsequent to the intrusion of the dikes and the faulting is indicated by the tendency of oreshoots to form on the under side of dikes and faults.

Sheared and Fractured Rocks

The Le Roi lode is from 20 to 40 ft. wide. The rocks of the lodes being sheared and fractured, but not brecciated, the first effect of replacement is to give an appearance like impregnation. Further replacement develops vein-like sheets, and the final result is the coalescence of these sheets and the formation of a solid replacement lode. Thus the entire width of sheeted rock is sometimes replaced and at other times only a narrow zone.

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[2]W. Lindgren, *Trans.* A. I. M. E., Vol. 30 (1901), pp. 644-645; W. H. Weed, "Copper Mines of the World" (1907), pp. 213-217; J. M. Maclaren, "Gold" (1908), 477-479; G. A. Young, *Rep.* Geol. Surv. of Canada, No. 1085 (1909), pp. 134-135; R. H. Allen, Eng. and Min. Journ., Vol. 89 (1910), pp. 17-19.

The metasomatic replacement is unique. Biotite replaces hornblende and invades the feldspars. Pyrrhotite and chalcopyrite replace augite, diallage and feldspars.

Character of Ore Deposit

The average value of the ore produced from 1894 to 1905 was $15.25 per ton. The average ore at present contains from $10 to $20 in gold and from 0.7 to 2 per cent. in copper, and a little silver. As much as 50 per cent. of the gold may be free. Sulphides make up from 60 to 75 per cent. of the ore.

The ore occurs in shoots which vary in size and shape. Lenticular bodies are most frequent, but many shoots enlarge and terminate abruptly against a dike or fault. The shoots vary in width from one to 30 ft. and in length from 50 to 500 ft., while the vertical dimension is greatest. They have marked pitches in various directions.

The ore varies from slightly mineralized rock to solid sulphides. Typically, it consists of more or less altered rock with reticulating veinlets, irregular masses and disseminations of lode minerals.

Principal Minerals

The principal metallic minerals in the ore are pyrrhotite, pyrite and chalcopyrite. Gold, arsenopyrite, marcasite, bismuthinite and molybdenite also occur and more rarely sphalerite and galena. Biotite and quartz are the principal nonmetallic minerals. Calcite, chlorite, hornblende, muscovite, touramaline, garnet, wollastonite, zeolites and epidote also occur. Limonite occurs in the shallow gossan.

The gold does not accompany any particular mineral. One authority states that in some places an increase in the amount of chalcopyrite denotes an increase in the gold tenor, while another says that pyrrhotite, pyrite and chalcopyrite are all auriferous but that the greater part of the gold occurs with the pyrrhotite.

The Saddle Reefs of Nova Scotia

Gold was discovered in Nova Scotia in 1860 and the first mining operations began at that time. The first veins to be worked were those of Tangier, 40 miles east of Halifax. The production rose from $142,000 in 1862 to a maximum of nearly $628,000 in 1902 and fell to about $225,000 in 1908. The total production from 1862 to 1907, inclusive, is estimated at $16,846,350.

The auriferous zone[3] of Nova Scotia extends in a broad belt along the entire Atlantic coast from Cape Canso on the northeast to Cape Saint Mary on the southwest.

[3]J. M. Maclaren, "Gold" (1908), pp. 461-467; C. R. Van Hise and C. K. Leith, *Bull.* 360, U. S. Geol. Surv. (1909), pp. 503-514; G. A. Young, *Rep.* Geol. Surv. of Canada, No. 1085 (1909), pp. 42-45.

Geological Features of Eastern Nova Scotia

The gold-bearing series of Nova Scotia is called the Meguma series and is probably of Algonkian age. It has an estimated thickness of 26,400 ft. and is divisible into two members: The Goldenville formation makes up the lower 15,840 ft. It is mainly quartzite, but contains numerous slate beds and a few conglomerates. Upon this rests the Halifax formation which is 10,560 ft. thick and consists chiefly of graphitic and ferruginous slate. The whole Meguma series has been thrown into sharp, nearly parallel folds with a northeast trend. This deformation probably occurred in Pre-Ordovician time. The sedimentary rocks are cut by numerous dikes, bosses and batholiths of granite. This granite was intruded in Oriskany time, subsequent to the folding of the sedimentaries.

Saddle Reef Ore Deposits

The Nova Scotian veins are mainly of the saddle-reef type which made Bendigo, Victoria, famous. They were formed during the folding of the region which probably took place in Pre-Ordovician time. The quartz veins were formed by the filling of cavities produced during folding, and the same solutions that filled these cavities impregnated the walls to a greater or lesser extent.

The Meguma series occupies 8500 square miles in southeastern Nova Scotia. Of this area, 3500 square miles are intrusive granite, leaving 5000 square miles of sedimentary rocks. All the gold-quartz veins that have been worked are in the Goldenville formation, and more especially in a shell situated from 2800 to 8000 ft. below the base of the Halifax formation.

Gold Mining Districts on Anticlinal Domes

The gold-mining districts are at points of doming along the anticlinal axes of folding. The average distance between the anticlinal folds is less than five miles, and the average distance from one dome to the next along the same anticlinal axis is from 10 to 25 miles. Most of the domes are centers of quartz-vein systems, although the veins are not always of ecenomic value.

The section across an anticlinal axis will show the sedimentary beds disposed in a vertical series of superimposed parabolic bands with intercalated saddles of quartz. These bedded quartz veins occur most frequently between strata of slate and quartzite, but are also found entirely within the slate and more rarely within the quartzite. When the anticlinal folds are broad, the veins do not usually occur at the anticlinal axis, but at a variable distance to one side of this and in zones from 200 to 1300 ft. wide, toward the center of which the veins are usually thickest and richest.

Bedded Veins a Common Type

While the bedded vein is the more common type, cross veins locally known as "angulars" also occur. These are usually parallel with the strike, but cut the dip, of the sedimentary strata.

The quartz veins often extend thousands of feet on their strikes. They have been worked to depths of 700 ft. The average thickness is from one to two feet. The crests of the saddles may be from 15 to 20 ft., or more, in thickness, but they rapidly thin out until along the legs of the folds their average thickness is only from four to 12 inches.

Veins Much Plicated

The veins, together with the adjoining layers of country rock, are frequently plicated. The plications vary from broad, open folds to close, overturned ones. Large, well marked corrugations are termed "rolls." Corrugation occurs most commonly when the veins are in slate, less frequently when they are in thin-bedded quartzite, and never when in thick-bedded quartzite. It is evidently due to the flowage of the softer rocks containing the veins when compressed between the more rigid quartzites. Banded structure is common in the bedded veins.

Character of Ore

The ore produced from 1862 to 1906, inclusive, averaged $8.97 per ton, while that produced in 1907 averaged $4. The average of some districts has been as high as $30 per ton, while in other districts lots of 100 tons or more have yielded as high as $70 per ton. The gold averages about $19 per ounce.

Gold is found both in the veins and the sedimentary rock. It is rare in the quartzites, but occurs more frequently in the slates. The ore is in shoots from 20 to 60 ft. wide. These shoots are sometimes at or near the intersection of bedded veins and cross veins and sometimes in "rolls" or swellings of veins.

The quartz of the veins is usually dark, ribboned and dense. Some calcite occurs with it. Pyrite and arsenopyrite are present in both veins and country rock. Pyrrhotite, chalcopyrite, galena and sphalerite are common in the veins.

The gold in the veins is in the form of filaments, leaves, and nuggets, or so fine it is not visible to the naked eye. In the slates, it occurs as thin plates. The larger particles of gold are found at the points of local enrichment in the neighborhood of vein intersections.

On an average 706 men were employed per day at the Alaska-Treadwell mine during the year ended May 31, 1910. The average wage was $3.45 per day.

The Vekol Copper Deposits

By Edwin Higgins*

These orebodies in Pinal county, Arizona, are limestone replacements along the intersections of two systems of faults. The ore is principally oxide and carbonate.

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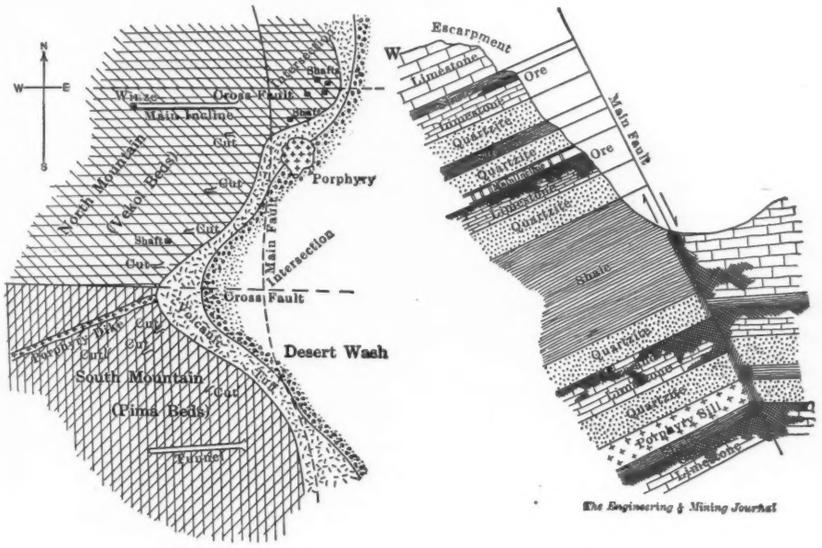
Although the area here described comprises 10 square miles, the notes on the ore deposits are based chiefly on conditions in the vicinity of the Reward group of claims where development has been carried to greater depths than in other portions of the district. These claims are six miles east of Vekol, in the Casa Grande mining district, in the southwestern part of Pinal county, Arizona. The nearest railroad station is Casa Grande, on the Southern Pacific, about 27 miles to the northeast.

Geology

The Vekol range rises abruptly from the level of the surrounding desert plain, trending north and south; its eastern face forms a bold fault escarpment in which stratified sedimentary rocks are predominant. The basal rock of the region is a complex of schistose character, which has been invaded by granitic and dioritic intrusives prior to the deposition of the Paleozoic and Mesozoic sediments. Following a later granitic intrusion, extensive faulting occurred, displacing the formation along north-south lines. A subsequent faulting was apparently accompanied by an intrusion of acidic porphyry, that appears in the form of dikes, some of which cut the formation in a northeast direction. This porphyry, probably monzonitic in character, also has been forced into the faults of the north-south system, which are the master dislocations of the region. It also forms stock-like plugs or masses of irregular shape, especially where the faults of the north-south system are cut by those of the east-west dislocations. This later intrusion, which is believed to be intimately connected with the copper ores, is called the Vekol porphyry.



Geological Plan and Section, Reward Claims

under the mountain at an inclination of 27 deg. from the horizontal and attaining a vertical depth of 392 ft. The portal is in the eastern face of North mountain at a point close to the intersection of a north-south fault with one of the east-west system. The ore in the stopes was evidently a replacement of the limestone just beneath its contact with an overlying bed of quartzite which forms the roof of the incline throughout its length. The ore bed is thicker and more prominently developed near the portal end of the incline than elsewhere, although ore of commercial value occurs throughout the full length.

The ore exposed shows the effect of thorough oxidation and leaching. Numerous slips or cross joints appear and these have doubtless formed the courses of descending surface waters. Many of the cross faults as well as irregular seams and fissures are filled with gypsum, testifying strongly to the extent of the leaching that has taken place. The form of the orebodies in the main incline is roughly and irregularly tabular; they are usually conformable to the dip of the inclosing beds and vary in width. At the portal end of the incline the red oxide of copper, mixed with earthy iron oxide and gypsum, predominates, but as depth is gained the carbonates are chiefly in evidence. Where the change from the oxide to carbonate appears there is a prominent cross joint; this doubtless diverted the oxidizing and leaching waters working down the bedding planes and carried them to deeper levels. The effect in this instance is so marked and the relations so plain that the influence of these cross joints and slips on the mineralization is strongly emphasized. The width of the ore beds, as shown in the stopes, is from 50 to 100 ft. The thickness varies from 3 to 10 ft. or more. The general trend of the ore zone is north and south and conforms closely with the line of strike of the great north-south fault that runs along the base of the escarpment forming the eastern face of the ridge.

Ore Occurrence

The deepest working of the district is in what is known as the main incline on the Reward group; the ore occurrence here is typical of the copper deposits. This incline is 600 ft. in length, sloping

Primary and Secondary Ores

Sulphide ores have been exposed in only one place, in the Phonodoree shaft of the Reward group. This shaft, near the extreme south end of South mountain, is down about 350 ft. vertically, and while still far above what is believed to be the level of permanent ground water, shows three beds of mixed sulphides of copper, iron and zinc. They are thought to be residual masses of the primary ores that for some reason have escaped oxidation at this level. Elsewhere all ores disclosed have been thoroughly oxidized and strongly leached. The occurrence of lime sulphate with the ores, together with large amount of iron oxide, and garnetized limestone, makes it reasonably certain that the primary deposition here, as has generally been the case in southern Arizona, was in the form of sulphides of the metals.

There are two principal factors that contribute to the production of secondary ores: First in importance is the existence of a thoroughly oxidized mass of gossan at the surface, together with a more or less extensive underlying zone of oxidized and leached copper ores. The second necessary factor is the presence below the zone of oxidation of primary iron and copper sulphides which serve to precipitate the copper leached from above. The total amount of leached material is great; much copper remains, as is usual, in the residue, but much also has been carried to deeper levels. The level of permanent ground water has been proved by a well to be in the neighborhood of 800 ft., so

that the zone of enrichment may be expected at about this depth.

Working Properties

The Jack Rabbit, about 10 miles east of Reward, is being developed by the Tube City Mining Company. The property has a shaft 400 ft. deep and is equipped with hoisting plant and machine shop, both housed. It is a silver producer. The old Vekol mine, another silver producer, about eight miles from Reward, is being operated by New Orleans capitalists with a small force of men. The Isabella Gold Mines Company, operating a few miles southwest of Reward, is installing a new plant and hopes to begin mining ore soon. Gold ore is mined here and R. E. Fishburn is in charge. Still further to the south in the Sheridan range, the southerly extension of the Vekols, the Brownell mine is reported on the eve of resuming operations.

The following prospects are now idle: The Copperosity (copper), on the west side of the Vekol range; Old Mammon (gold); Lake Shore (copper); Chamberlain (copper); Christmas Gift (gold). All of these properties have been worked in the past and have produced ore of shipping and milling grade. With increased transportation facilities and further development some of them should again become productive.

The Atlantic Pebble Company has been granted a concession by the Newfoundland Government for the exportation of pebbles from the shores of Conception bay. The company's present operations are at Long Pond, near Manuels, 15 miles from St. John's. The first shipment was sent to Philadelphia in July of last year.

Tin in 1910

The following is an abstract of part of a recent review by W. T. Sargent & Sons, of London: Until the last three or four months of 1910, supplies of Straits, Banka and Billiton tin were much the same as in 1909; the last four months, however, developed a sharp falling off in the Straits exports. The floating supply of tin in Singapore and Penang became almost exhausted. The total falling off of exports was about 5800 tons. The reason for this lies mainly in the enormous development of rubber planting in the Straits and the Mid-East, which have needed large quantities of labor. On a moderate computation, it is reckoned that 100,000,000 rubber trees have been planted in the Mid-East, and the upkeep of the plantations has raised the cost of labor all around, in addition to diverting capital and energy which otherwise would have been engaged in tin mining.

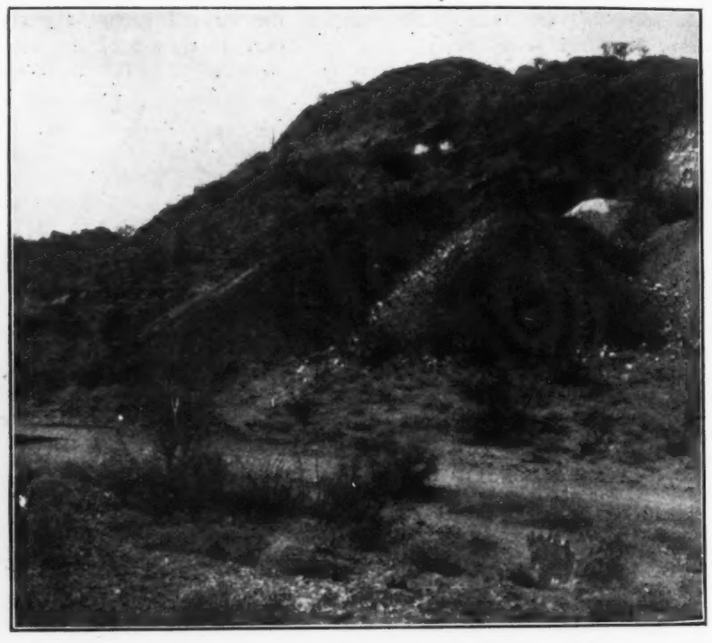
The effect of this has been also largely felt in the sporadic tin mining which has always furnished a large proportion of the tin output in the Straits; while as the tin found there is entirely alluvial, many of the easier and more accessible deposits have been exhausted in the last 10 years. Unless prices advance decidedly, we can only expect moderate supplies from the Straits.

Banka sales in 1910 increased by 1500 tons, and for 1911 a further 1500 tons increase is announced, bringing the quantity of Banka and Billiton available to 17,300 tons. Bolivia about maintained its output, the quantity exported being about 250 tons more, while the grade of ore arriving in Europe was higher. Australia exported about 700 tons less to Europe and America. China exhibits a good increase in the exports to Europe and America, but whether this is due to less tin being sent to the Straits for smelting is not yet clearly ascertained. However, it is to be noticed that the smelting in China has been greatly improved, and the tin sent to Europe has been mainly of a very high grade, and much superior to the metal exported in former years. In Cornwall the production increased slightly.

Nigeria has figured rather largely in tin-mining enterprise, and there is no doubt that in the territories of the Niger Company extensive deposits of alluvial tin have been discovered. During 1910 about 1500 tons of metallic tin were shipped. The deposits are, however, a long distance from the railway, and until this reaches the tinfields the output is not likely to be of a character to influence the price of the metal. Little has been heard of the South African supplies, but the railway is fast approaching the Tanganyika deposits, and something should be heard of these in the next two or three years. It will be thus seen that as regards supplies there is no great likelihood of these exceeding the usual increase in consumption, and there may be a deficiency in the early part of 1911.

Reviewing the whole situation, we may look in the first half of 1911 at least for consumption to outrun the supplies, and this should leave the "bull" clique, who are believed to control about 10,000 tons, pretty well masters of the situation. What may happen when this holding comes to be liquidated, is on the knees of the gods, but apparently the metal will live up to its record of big fluctuations.

The Phonodoree Shaft Near Vekol, Ariz.



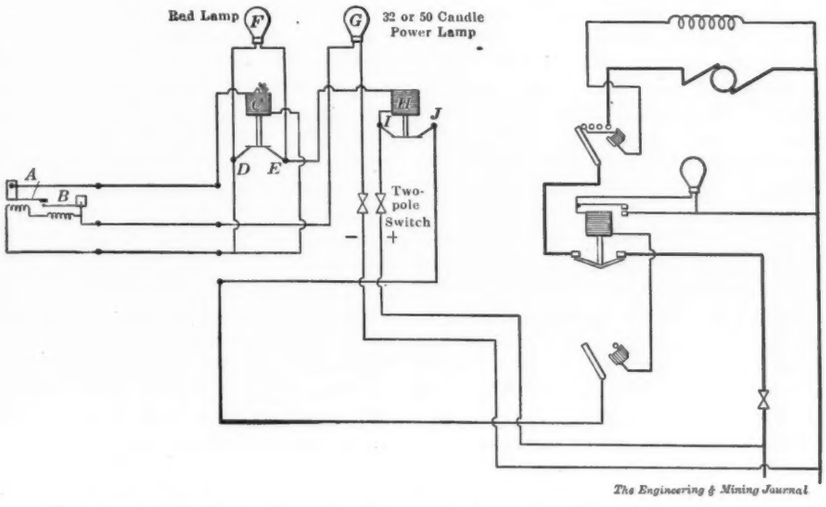
The Reward Incline, North Mountain

Coal Mining Department

The Important News Of Coal Mining. New Appliances, New Methods. New Fields, Colliery Engineering

The Holmes-Alderson Automatic Firedamp Cutout*

In view of the large and ever-increasing use of electricity for power purposes in mines, George J. Ralph, an English engineer, considers it is important that advantage should be taken of all satisfactory safety appliances which human ingenuity can devise, to minimize danger from shock, fire and explosion. The Holmes-Alderson automatic firedamp cutout has been designed to detect the presence of firedamp, and in conjunction with suitable relay cutouts, to interrupt the supply of electrical energy to motors or other apparatus in the neighborhood as soon as, or before, firedamp is present in sufficient quantity to render the use of such energy a danger. It is, at the same time, adapted to give warning of the fact by a visible or audible signal, and is sufficiently sensitive to operate in a 2 per cent. mixture of gas and air; however, the machine may be set for any larger percentage as desired. It is equally applicable to direct-current and alternating-current circuits, and consumes but a small amount of current—between one-half and three-quarters of an ampere.



CONNECTIONS FOR THE HOLMES-ALDERSON AUTOMATIC FIRE-DAMP CUTOUT

The apparatus is the invention of Mr. Alderson, and depends for its operation on the catalytic action of platinum, or, in other words, on the fact that platinum increases in temperature in the presence of hydrogen or marsh-gas.

DETAILS OF APPARATUS

The apparatus is contained in two separate cast-iron boxes, the detector itself consisting of two strips of metal (shown at *A* and *B* in accompanying figure) each composed of two pieces of dissimilar metals, such as steel and brass, having different coefficients of expansion. Each strip is rigidly fixed at one end, while the free ends overlap each other slightly, but under normal conditions do not make contact with each other. Any heating of these strips causes bending or curving to take place on account of one metal expanding more than the other, and below the strips are disposed coils of thin wire, one coil being of platinum, and the other of some metal which has no catalytic properties.

Under ordinary conditions, on passing a current through the coils, the metal strips above are curved up equally by the heat and therefore do not make contact.

Mr. Ralph proceeds to say that variations of atmospheric temperature, or variations in the supply of voltage, affect both coils equally; but should the atmosphere contain a sufficient percentage of firedamp, the platinum coil will increase in temperature, and thus cause the compound strip, *B*, above it to curve to a greater extent than before, sufficiently so to make it come in contact with the other strip, *A*. When this happens, a circuit is completed through the small magnetic solenoid switch, *C*, and the core of this switch carrying a connecting plate, being lifted, separates two spring contacts, *D* and *E*. The separation of these contacts causes the lamp, *F*, to be connected in series with the lamp, *G*, and also with the heating coils; at this time the lamp, *F*, lights up brilliantly, and being colored red, acts as a danger-signal. The current is so much reduced by this additional lamp being thrown in series with the circuit, that the heating coils cool down and the lamp, *G*, is much dimmed.

Preferably, Mr. Ralph says, the cutout box should be mounted on a panel containing the motor switch-gear, and contains another magnetic solenoid switch, *H*, the core of which also carries a plate which connects or disconnects two spring contacts, *I* and *J*. These contacts are connected to the motor starting switch-gear in such a manner that a circuit from one to the other through the connecting plate will cause the current to be cut off from the motor.

Should gas be present in sufficient quantity, the compound strips in the detector will come into contact, and these strips being connected to the circuit through the magnetic solenoid switch, *C*, the core of this will be lifted and the contact springs, *D* and *E*, separated, so lighting up the red lamp, *F*, and thereby reducing the current so much in the magnetic solenoid switch, *H*, that its core will fall and disconnect the contact springs, *I* and *J*.

As the current in the magnetic solenoid switch, *H*, is reduced, the current is likewise reduced in the platinum coil of the detector, and as this cools, the compound strips will separate again. The main switch cannot operate, however, since its solenoid coil is opened by the springs, *I* and *J*, being disconnected. The core of the magnetic solenoid switch, *C*, is so constructed that when it has lifted, it will remain in that position until it is released by hand, to do which it is necessary to unlock the cutout box.

The author says that, owing to the magnetic solenoid switch, *H*, being in series with the lamp, *H*, and the detector coils, if the lamp should burn out, or the detector coils break, or any disconnection occur in the cutout circuit, the core of the magnetic switch will drop to the safety position and prevent the motor switch-gear from operating.

By the courtesy of the secretary of the Institute in supplying an engraving we are enabled to reproduce the diagram of connections of the apparatus.

*Abstract of a paper presented at the Dec. 10 meeting of the North of England Institute of Mining and Mechanical Engineers.

Insulation of Cables in Mines

By Sydney F. Walker *

Detailed information regarding the different insulating materials, and a discussion of the troubles caused by defective insulation. Advisable precautions.

*Bloomfield Crescent, Bath, England.

It has occurred to me on reading the excerpt from the *Journal of the Transvaal Institution of Mechanical Engineers*, on "The Insulation of Electric Cables" in the JOURNAL of Dec. 10, 1910 that some further information as to the materials used may be of service. At the present time there are three insulating materials employed, india rubber, bitumen and paper. Gutta-percha was used for the insulation of electric signal wires, in the days when signals were the only electrical apparatus about a mine, and to a small extent for electric-lighting cables, when lighting was first introduced. Gutta-percha, however, has quite passed out of the sphere of practical insulation of cables for mines, and pretty well for everywhere else. If the conductor heats at all, as it is liable to do in most every case where current is distributed for lighting or power, the gutta-percha softens, and the conductor is apt to force its way through the softened material, the insulation on that side being considerably reduced.

Pure Rubber the Best Insulating Material

All three of the materials mentioned are used in several different ways. India rubber is the material that has been used for the longest time, and still remains, in my opinion, by far the best of the three. The great objections to it are, as explained in a previous article, the much higher expense, if a really good insulating envelop is to be obtained, and the difficulty, even when a comparatively high price is paid, of insuring that good rubber is obtained.

For certain purposes pure rubber is used for the insulation of conductors. It is laid on spirally in strips, under tension, the successive layers being spiraled in opposite directions, so that the joints of the spirals overlap each other. The rubber covering is protected usually by braiding, and outside of all, by one of the so called waterproof compounds that are on the market. Conductors insulated in this way should not be used except for very low pressures, certainly not above 110 volts or so, and should never be employed in damp places.

For very low pressures, and in dry places, where the ordinary atmospheric conditions rule, and where the usual amount of moisture is present, small conductors insulated in this way, should stand very well. The rubber strips put on under tension form a fairly homogeneous tube, though not sufficiently so to prevent the ingress of moisture. Rubber of any kind, it may be mentioned, does not stand either moisture or grease. The gums of which the rubber is composed, readily oxidize in the presence of moisture, and the rubber then tends to break up, the moisture having further ingress to the layers underneath, and to the conductor.

Trouble Caused By Defective Insulation

With small conductors, trouble often arises in damp places from the conductor itself being eaten in two. Where the insulation is defective, moisture works its way in, and attacks the copper conductor, the current often assisting it, the result being that the service supplied by that conductor is broken down. With electric signals, worked by india-rubber covered wires, this trouble used to be frequent. It was difficult to keep the wire out of the wet, and as surely as wet reached it the conductor would be parted sooner or later. It had a nasty knack also of parting at some inconvenient time.

Pure rubber strip is also largely employed for the insulation of the flexible cords used in connection with portable and pendant lamps. The flexible cords are made of two insulated conductors stranded together. Each conductor consists of a number of very fine wires twisted together, the object being to obtain great flexibility. The twisted conductor is often insulated by wrapping pure rubber strip around it, in the manner described above for small conductors, two or three layers being employed. The rubber covering is protected by a braid of cotton, mohair or silk, the braided conductors being then twisted together to form the flexible cord.

Again, the pure rubber insulation answers well for low pressures, not exceeding 110 volts, but in my opinion should not be used for higher pressures. In the United Kingdom there is a considerable difference of opinion among electrical engineers upon this point. Flexible cords that are used with the pressures now ruling in towns, 200 to 260 volts, are insulated with vulcanized rubber. The vulcanized rubber, forming as it does a complete tube, is a better insulator, offers a higher resistance to sparking, and should be better in every way for the higher pressures. The great objection raised to it, is its tendency to break up into short lengths, like short pipe stems. In my view, this should only arise where the rubber is not good, and the process by which it is put on is not properly carried out.

Precautions in Laying On Rubber

In laying on rubber, certain precautions have to be taken with the conductor itself. Rubber contains oxygen, which freely attacks the copper of the conductor, if the rubber is brought directly in contact with it. For all conductors insulated with rubber therefore, except the flexible cords mentioned above, the wires are always tinned before the rubber is laid on, and this applies equally to insulation by pure rubber strip only, and also to the vulcanized rubber described below. A point that is of the utmost importance is, that the tinning of the copper wire shall be complete.

With all the processes where one metal is laid over another for protection, if the covering of the outer metal is not complete, the action which it is desired to protect the under metal from, commences wherever there is a break in the covering, and goes on under the covering along the conductor. It goes without saying, that any impurity in the copper conductor, any defect in the drawing of the wire, accentuates any trouble that may arise from imperfect tinning. Tin is a metal which has a very small affinity for oxygen, and it therefore affords a good protection to the copper, providing the copper is pure and the tin covering is everywhere complete. If the copper is impure, galvanic action is liable to be set up, which the tin may take part in, and other troubles ensue. It is more than probable that some of the mysterious faults that have arisen in cables, where the cables themselves have been parted, have been due to impure copper, or to flaws in the copper, combined with imperfect tinning.

In the case of the flexible cords, the small wires are not tinned, as it would make them too brittle, and brittleness is one of the faults that all flexible conductors, all conductors built up of a number of small wires, are liable to. To prevent the contact of the rubber with the copper conductors, the latter are covered with a thin layer of cotton laid on transversely. For the great majority of purposes for which rubber-insulated cables are used, vulcanized rubber is employed. The process is as follows: The conductors are tinned and are stranded together, where more than one conductor is employed. In the usual arrangement six wires are laid up around a seventh, cables being constructed with this formation, till the individual wires become so large that the cable formed by seven of them is unwieldly.

A second group is formed by putting on 12 wires outside of the seven, forming 19 altogether. A third group is formed by putting on 18 outside of the 19; a fourth group by putting on 24 outside of the 37, forming 61, and a fifth group by putting on 30 outside of the 61, forming 91. The different groups are known as 7/16, 19/16, 37/16, 61/16, 91/16, or 7/12, 19/12, 37/12, 61/12, 91/12, and so on. These figures mean, 7 No. 16 wires, 19 No. 16 wires, and so on; 7 No. 12 wires, 19 No. 12 wires, and so on.

To Prevent the Sulphur Reaching the Conductor

The finished conductor, whether single or stranded, is first insulated by strips of pure rubber laid on spirally, as explained of pure-rubber insulation. It is usual to put on two layers of pure rubber, though sometimes three are employed. The pure-rubber layers are provided to prevent the sulphur which is employed in the remaining portion of the insulating covering from reaching the conductor. Outside of the rubber insulation, there is a layer of rubber, compounded with a salt of sulphur. This layer is known as "intermediate." Outside of "intermediate" is placed the "jacket," which is prepared from pure rubber and other substances. The "intermediate" and the "jacket" are laid over the cable longitudinally, special apparatus being employed in the machine which lays on the "intermediate" and the "jacket," at the same time to cut off the substance exactly in the right quantity, and to seal the two edges together. Intermediate and jacket are usually put on in the same machine, intermediate being a little in front of jacket, and the joints of the two are at right angles.

After intermediate and jacket have been put on, the insulated conductor which has been coiled on a drum, as it comes from the last machine, is put in the vulcanizing oven, where it is exposed to the heat for a certain number of hours. The effect of the heat is to weld pure-rubber strips, the intermediate and the jacket into one continuous envelop. If the process has been properly carried out the enveloping insulator is exactly like the small rubber tubes that are sold for different purposes, but it is closely enveloping the conductor. The thickness of intermediate and jacket may be varied at will, and also it is in these that the quantity of "Para" rubber is varied.

For high insulation thickness is not so much necessary, as a larger proportion of Para rubber. On the other hand, for resistance to sparking, radial thickness is necessary, and for resistance to the effects of damp, which cables are so subject to in mines. My view has always been that a rubber-covered cable having a radial thickness of not less than 1/10 in., and as much more as the proprietor of the mine will pay for, is the best form of cable to be employed in mines. Some 14 years ago I was given carte blanche by the manager of a mine in South Wales, to send him a cable insulated so that it would stand. The size of the cable was 19/16. I sent him a cable insulated with rubber, as described above, the radial thickness being ⅛ in. I heard the other day that the cable was still in use.

Concentric Cables

Concentric cables are made in exactly the same manner, up to a certain point. By a concentric cable is meant the two conductors placed in the same cable, one outside of the other. The inner cable is made and insulated just as described above, but the insulating envelop is always rather thicker than it would be if the cable were merely single. The insulator is protected by braidings and layers of jute, and the other conductor, which has the same total sectional area as the inner one, is laid on outside of the braiding. Usually the outer wires are in a single layer, unless there are a large number of them, and it is a large cable, in which case there may be two layers.

Bitumen Insulation

It may be interesting to note that all of the insulating materials employed, rubber, bitumen and the resinous oils used with paper, are of the same nature, viz., hydrocarbons. It is interesting for this reason; that is, the fact that if sufficient heat is applied to the insulating envelop, the insulator will be converted into gas, which, being a hydrocarbon, has the same properties as the gas met with in coal mines. If it be mixed with a certain proportion of air, and heat of a sufficent temperature is applied, an explosion follows. In the United Kingdom there have been several explosions under the streets, due to this cause. What is termed a short circuit has occurred between two cables, the short circuit being followed by an arc between the points where the conductors were in contact, the heat developed by the arc has converted the insulating envelop into a gas, and when a sufficient quantity of the gas has been formed, if there has also been a sufficient quantity of air present to mix with it, an explosion has followed. The Corporation of Manchester had to pay rather heavy damages, owing to a matter of this kind. A short circuit occurred in a cable under the street, and the gas formed found its way into a house adjoining, where it mixed with air, and was ignited by a naked light, an explosion following.

Bitumen, it will be remembered, comes principally from Trinidad. It is found in the asphalt lakes there, and in some other parts. When mined, it naturally contains a considerable quantity of dirt, and the first processes through which it is put are designed to remove the dirt. It melts at a low temperature, and is therefore easily converted into liquid, and the foreign matter removed when it is in that state. For the purpose of cable making, it is combined with sulphur, and is used in several different ways. When combined with sulphur and exposed to a certain amount of heat, it is known as vulcanized bitumen, it being claimed to have some of the properties of vulcanized rubber; that is, an increased resistance to moisture and to oils. Bitumen insulation has been largely used in mining work, because it is so much cheaper than rubber and while, as explained above, it has been exceedingly difficult to be sure of having good rubber, there has been no difficulty in securing good bitumen. The insulation resistance of bitumen is considerably less than that of rubber, but it is quite sufficient for mining purposes, and for a good many other purposes, so long as it remains in fairly good condition. It resists wet quite as well as rubber, providing that the envelop remains intact.

One great difficulty in connection with the use of bitumen, as generally applied, it is soft and liable to crack. The great firm of Callenders, the founder of which I believe came from America, and who have done so much to introduce bitumen-covered cables, use the material for the insulation of cables in two ways. In one class of cables, the dielectric, as it is called, the insulating envelop consists of either paper or spun-jute fiber, laid on the outside of the conductor spirally, in the same manner as the pure-rubber strips are, except that the paper or jute fiber is not exposed to so much tension as the rubber.

The paper or jute fiber after being laid on the conductor to whatever thickness may be arranged, is impregnated with a mixture of bitumen and oil, which the Callender company has worked out specially for this purpose. The radial thickness of the paper or jute covering for this class of cables ranged from 0.08 in. for small conductors, up to 0.13 in. for large ones. The insulated conductor is protected by a lead tube made upon the cable as it passes through a machine arranged for the purpose. Virtually this form of bitumen cable is one of the paper or jute cables and is subject to the same conditions as they are. The lead covering must always be intact. If moisture penetrates the insulation is gradually lost.

In Some Cases the Conductor Is Covered with Yarn

In the other class of cables made by the Callender company, the conductor is first covered with a thin layer of yarn or paper, called a separator, and a tube of vulcanized bitumen is then forced on under pressure, in a similar manner to the lead tube in the class previously described. The radial thickness of the vul-

canized bitumen tube ranges from 0.1 in. with small conductors, up to 0.24 in. with large ones. Both classes of cables are sent out, either merely braided overall, or armored with wires or steel tape.

The Callender Company also makes concentric, and triple concentric cables, with inpregnated paper insulation, and with tubes of vulcanized bitumen. When vulcanized bitumen is used with concentric or triple concentric Callender's cables, the intermediate insulation between the two sets of conductors, is of paper or spun-jute impregnated with bitumen and oil, and there is a similar insulation outside of the outer conductor, laid on before the bitumen sheath.

The Triple Concentric Cable

The triple concentric cable, as its name implies, consists of three conductors, laid on concentrically, one outside the other. The inner conductor is stranded in the usual way as described, the first outer conductor is laid on in one or two layers, outside of the insulating envelop of the inner conductor, and a third conductor is laid on outside of the insulating envelop of the second conductor, an insulating envelop being laid on outside of the third conductor usually, and bitumen or a lead tube outside of all. The triple concentric cable is used with what is called the three-wire system, with continuous currents. In the three-wire system, double the pressure that is employed on the lamps is used for motors. Thus, the generators may be furnishing current at say 500 volts, and it will be supplied to the motors at this pressure. Lamps will be furnished with current at 250 volts, and they will be bridged between the two conductors proper, the outers as they are termed, of the three-wire system and a third wire, whose office is merely to carry the current from one set of lamps to another.

The three-wire system is largely employed in town work, and has been employed to a small extent in mining work in the United Kingdom. It may be mentioned that in the United Kingdom, electrical work in mines is approaching closely to town practice. In my opinion this course is not a wise one.

Bitumen is also used for the insulation of mining cables in another form. Messrs. Glover use it for the outer sheath of their paper-covered cables, in place of lead. I am referring to their paper-covered cables below. Bitumen is also used in another form for the insulation of cables, by the St. Helens Cable Company, of Warrington, England. The vulcanized bitumen which the St. Helens Company employs is known as "dialite," from the name of the inventor, Mr. Heyl Dia. "Dialite" is claimed to have certain properties which the ordinary vulcanized bitumen does not possess. It is prepared in exactly the same manner as the vulcanized bitumen described above, but a substance is added, which the manufacturers keep to themselves, which it is claimed gives it a higher melting point, and renders it less liable to attack from moisture or oils.

A few years back, I had to report upon the matter for a mine that I was advising, with reference to their electrical installation. I investigated the matter as fully as the materials at my disposal allowed, the makers placing every facility at my command, and I made out that the claim for a higher melting point, greater mechanical strength and less liability to attack by water and oil, was substantiated. Dialite, as I understand, is not put on the cables in the same manner as vulcanized bitumen usually is. As mentioned above, the vulcanized bitumen is usually pressed on to the cable by means of a die, just as a lead tube is, the conductor passing through the die, and the tube of bitumen being formed directly on and around the conductor as it passes through. With "dialite," the finished substance is made into sheets, very much on the same lines as rubber, cut into strips, and laid on the cables spirally. It is the vulcanizing process to which the cable is subject after the insulation is laid on, which welds the strips into one homogeneous tube. "Dialite" cables are sent out either protected with jute, yarns, tapes and braid, or armored, as in other cases. They are also made in the concentric and triple concentric forms.

Paper Covered Cables

Paper-covered cables are really resinous oil cables. Paper is one of the best insulators known, providing that it is dry; but it is porous and easily absorbs moisture, and hence the paper must have its pores filled also with some insulating substance. Some years back, there were a number of cables on the market, insulated with yarns, impregated with resinous oils, and in the earliest form which was employed for this insulation of the distribution cables at Worcester, England, the oil in the lead tubes containing the conductors and the yarn, was maintained under pressure by connection with an oil tank placed at any convenient part of the service. Modern cable making however appears to have settled down to paper coverings. As with rubber, there is a large difference in the quality of paper-covered cables. As with everything else, there is paper and paper.

For good insulation, the best manilla paper, with a strong fiber, should be employed. If inferior paper is employed, it is apt to tear and break, in the process of being laid on the conductors, the result being imperfect insulation, cavities where moisture can lodge if it creeps in, and early break-downs. It may be mentioned that paper-covered cables usually break down, when they do, in the following way. Some aperture is made in the lead covering, say by the pick of a navvy working in the street, or in the case of a mining cable by a sharp bend, or by rubbing against the sharp edge of some metal object. Whatever the cause of the break in the lead covering, moisture enters. It does not immediately break the cable down. There is always a capillary space inside of the lead envelop, beween it and the paper covering of the cable, and any moisture which enters, creeps along this space. If there are no faulty places in the insulator, general deterioration of the insulation ensues, by the gradual watering of the oil. Resinous oil is a good insulator, but it loses its insulating properties, pretty well in proportion to its dilution with water. It generally happens, however, that, even with cables made under the very best conditions, and with every care in the selection of the paper, with every care in laying it on, with every care in putting the cables into its place, some faults exist, some breaks in the paper. With inferior paper, the brakes may be many. In either case, if the moisture finds one of those breaks, it proceeds to act upon the oil very much more vigorously than where the whole insulating envelop is intact, and in particular at the fault, deterioration of the insulation, and of its resistance to sparking, goes on rapidly.

The Process Known as Osmosis

As mentioned in a former article, there is another very peculiar process going on in electrical cables, known as osmosis. This process may be best illustrated by a simple experiment that anyone can make for himself. Take an ordinary Le Clanché battery jar, and partly fill it with water. Take a porous jar, such as is used for the carbon element of a Le Clanché cell, or for a mercury bi-chromate cell. The porous jar should be empty when taken for the experiment, and should then be partly filled with water and placed in the battery jar.

Take now two carbon plates, immerse one in the porous jar, and the other in the outer jar, and connect the two to any source of current, such as an ordinary Le Clanché cell. After a certain time it will be found that the water has moved in the direction of the current. If the carbon plate in the outer jar has been connected to the positive side of the source of current, the water will have risen in the porous jar, and *vice versa*. The action may be thus described. Any liquid which is free to do so and which is exposed to the action of an electric current, will move in the direction of the current, from the positive to the negative side. Thus, if the conductor of a paper-covered cable is positive, the oil will tend to move toward the lead covering; and in the negative cable the oil tends to move toward the conductor. In the case of the negative cable, the movement of the oil toward the conductor tends to

leave the outer layers of the paper less impregnated with oil, and therefore more exposed to the action of moisture.

Modern paper-covered cables may be broadly divided into two classes. The majority of makers lay the manilla paper spirally upon the conductor, layer upon layer, till the required thickness is obtained, and then either draw the covered conductor into a lead tube, and force the oil into the paper, or draw the covered conductor through an oil bath, in which the oil is forced into the paper under pressure, putting the lead tube on afterward. This is the method employed by the British Insulated Wire Company, which has made such a large quantity of cable for street work, and whose cables have also been used largely in mining.

Dia's Insulation

Messrs. Glover have another method, also invented by Heyl Dia, who has given his name to the "dialite" bitumen process of the St. Helens Company. In Messrs. Glover's method, the paper is first impregated with an oil, to which is added some substance which gives it a certain stickiness. The paper when impregated has a glossy appearance, and sticks to the fingers. It is cut into strips, and laid on the conductor spirally, in the manner already described. The strips adhere together, in consequence of the nature of the substance with which they are impregated, and it is claimed that the oil does not tend to run so easily as in other processes, and a more solid insulating envelop is obtained. The method of insulation is known as "diatrine" from the inventor. Diatrine insulated conductors are drawn into lead tubes, the tubes being formed upon them as already described, and also into vulcanized bitumen tubes.

All paper-covered cables are sent out with their lead or bitumen coverings protected by jute, braids, tapes, etc.; and armored with galvanized wires, or galvanized-steel strip. They are all made in the concentric and triple concentric form.

One form of armor may be mentioned in conclusion, that is, the type known as the locked coil. The locked coil rope is well known to readers of The Engineering and Mining Journal. It has been on the market for a number of years. In it, it will be remembered, the wires are drawn to a special section, which enables them to be locked together, when laid into the rope, each circle of wires forming a cylinder, and there being a number of concentric cylinders to form the rope. Locked coil armor has been employed in the United Kingdom, to protect insulated cables of all kinds.

The owner of every coal mine should provide one approved "ambulance box" for each 100 men employed underground or on the surface.

New Method of Testing for Gas in Mines*

Special Correspondence

R. D. Cochrane claims that his device provides a simple, accurate, scientific and quick means of ascertaining the presence of gas even in cases of less than 1 per cent., without any of the ordinary risks and disadvantages associated with a safety lamp when used for that purpose. The lamp is of the ordinary bonneted Marsaut type, with the important addition of a diaphragm, with a central opening, rigidly suspended over the wick tube by depending rods. These are screw-threaded at their face ends, and as each is furnished with two nuts they afford a simple means whereby the position of the diaphragm may be adjusted relatively to wick tube.

The diaphragm not only provides for uniformity in the hight of the flame, for ordinary lighting purposes, but also forms a permanent datum from which the spires can be measured; to facilitate observation, a vertical scale is attached.

No special trimming of the lamp is needed other than that necessary for the exercise of its proper functions as a source of light, consequently there is no risk of the lamp going out, a contingency which is ground for constant anxiety when the flame has to be reduced to the minimum when a test is being made. Lamps so fitted thus combine the triple functions of an ordinary miner's lamp, a testing lamp and a means for lighting the user from place to place, without any special adjustment being necessary. As there is no fear of being left in darkness, the necessity does not arise to carry a second light.

Tests Made with the Lamp

Tests made with the lamp by Prof. G. R. Thompson, of Leeds University, are given with the paper as follows, the tests being made with two diaphragms and with three different illuminations:

Diaphragm No. 1—Opening, oblong in shape, 17/32 by ¼ in.; hight above top of wick tube, 7/16 in.; illuminant, ordinary paraffin oil. With the equivalent of 1 per cent. of firedamp in the chamber, the flame spired up to a lurid yellow cone, feebly luminous at the tip, which reached to ⅝ in. above the top of the diaphragm; with 2 per cent. the spire increased in hight to ¾ in. above the diaphragm, and with 3 per cent. the spire increased to slightly over 1 inch.

Diaphragm No. 2—Opening, oblong in shape, 9/16 by 9/32 in.; hight above top of wick tube, 7/16 in.; illuminant, ordinary paraffin oil. With 1 per cent. of gas the flame increased in hight and reached to about 3/16 in. above the diaphragm (the tip was, however, bright and the flame did not spire); with 2 per cent. the flame reached ¼ in. above the diaphragm, being still bright at the tip, but at times tending to spire and becoming then lurid yellow at the tip; with 3 per cent., the flame spired up into a lurid yellow cone, rising ¾ in. above the diaphragm.

Diaphragm No. 1—Hight, as before; illuminant, lamp oil, evidently a paraffin oil of high flash point. With 1 per cent. of gas, the flame spired up to ⅝ in. above the diaphragm; with 2 per cent. the flame spired up to ¾ in., and with 3 per cent. the flame spired up to slightly over 1 in. It will be noticed that the indications with this oil were the same as those given by ordinary paraffin with the same diaphragm.

Diaphragm No. 2—Hight, as before; illuminant, colza oil. With 1 per cent. of gas the flame increased in hight, reaching to about 1/16 in. above the diaphragm (the flame was clear and bright and did not spire); with 2 per cent. the flame increased in hight, reaching from ⅛ to 3/16 in. above the diaphragm, heaving slightly, but being bright and not spiring; with 3 per cent. the flame increased in hight to about ¼ in. above the diaphragm, sometimes heaving up to 3/16 in. above, and showing then a slight tendency to spire.

Explaining the different indications between colza and paraffin oil, Mr. Cochrane says the colza oil, being less volatile, required the wick to be pushed higher above the wick tube, and thus the flame when adjusted to the hight of the diaphragm was smaller than that produced from the volatile oil.

*From paper submitted by Ralph D. Cochrane, at a meeting on Dec. 10, of the North of England Institute of Mining and Mechanical Engineers.

COLLIERY NOTES

The New River & Pocahontas Consolidated Coal Company, operating in McDowell county, W. Va., has begun shipments at its new No. 4 mine, at Berwind. The plant is one of the most modern in southern West Virginia. Steel mine props will be used.

The West Virginia Supreme Court has decided that coal companies who employ boys under 14 years of age, the limit set by statute, are liable for any injuries that may occur to them. The decision grew out of a case for damages for a boy under the legal age of such employment, for the loss of a leg. His parents were awarded $1500 damages.

The by-product coke-oven plant which H. Koppers has been building for the Lake Superior Corporation, at Sault Ste. Marie, Ont., will be completed about the end of February. No. 1 battery of 55 ovens is now ready and will be producing coke soon. The brick-work on No. 2 battery of 55 ovens is all completed and it will be ready to produce coke in March.

NEW PUBLICATIONS

LAGERSTAETTEN DER NUTZBAREN MINERALIEN UND GESTEINE NACH FORM, INHALT UND ENTSTEHUNG, by F. Beyschlag, P. Krusch and J. H. L. Vogt. Second half of the first volume. 8.60 marks. Ferdinand Enke, Stuttgart.

The first half of the first volume of the above work (Deposits of useful minerals and rocks according to shape, contents and origin) was reviewed in the JOURNAL of July 16, 1910. It dealt with the introductory subjects of structure classification, evaluation and the like. The present portion takes up magmatic segregations, contact deposits, and the groups of tin and quicksilver veins. The last two groups are not limited to the metals tin and quicksilver, but embrace related veins which are similar in their geological relations. All the topics possess exceptional interest, in that they largely embrace the types of orebody, in the study of which the modern advances have been especially made. It would, moreover, be impossible to assemble three authors who could bring to bear upon these subjects fuller knowledge or riper experience.

The first part of Vol. 1 closed with the discussion of the classification of ore deposits. Four main divisions were established: (1), Magmatic segregations; (2), contact deposits; (3), deposits in fissures; in cavities, and those formed by replacement; (4), beds. The second part begins with the elaboration of magmatic segregations. To the treatment of this topic Professor Vogt brings especially wide experience, not only in the study of ores themselves, but also of mattes and slags.

Useful minerals of magmatic origin are subdivided into: (a), Oxides, embracing chromites in peridotites; titaniferous iron ores in gabbros, etc.; nontitaniferous iron ores and rich apatite iron ores in acidic rocks; rutile in granite, and corundum in peridotite; (b), sulphides, embracing nickel-bearing pyrrhotite with a few related copper deposits and certain intrusive sulphides; (c), native metals, embracing nickel-irons, platinum, copper and gold.

Under the oxides all the chromite of the serpentines is referred to an igneous origin and the serpentines themselves to original peridotites. Since the discoveries of chromite in fresh peridotite on the Island of Hestmandö, just under the polar circle off the coast of Norway, original peridotites for these chromite-bearing serpentines may be assumed with entire propriety. The titaniferous magnetites are believed to be mechanical mixtures of magnetite and ilmenite, a conclusion which is supported by investigations in Norway and some unpublished work in this country. Professor Vogt is cited as of the opinion that the extra coke consumption of the iron ores of this type has been exaggerated. Magnetic concentration of the iron with elimination of the titanium is pronounced an encouraging field of investigation.

The nontitaniferous iron ores of the acidic rocks present an interesting topic, embracing as they do, the great Swedish deposits at Kiruna and Gellivare. The authors support the view that these and other orebodies in Scandinavia are differentiation products of an acidic magma. Much interesting matter, which will probably be new to the majority of American readers, is given under this head. Rutile in the granite dikes in Norway and Virginia is the last of the oxides treated. The authors appear to have overlooked the corundum of the nephelite-syenites of eastern Ontario, which also furnishes an important member of this series and is widespread in the rich alkaline rocks of the region cited. The curious rock kischtimite of the Urals is a similar case. Corundum is only mentioned in the peridotites and is placed as a subordinate case after chromite.

SOME SULPHIDE BODIES CONSIDERED INTRUSIVE

The segregation of sulphides in igneous masses affords another topic of great interest. Many cases the world over are passed in review. But what will strike most readers in America as novel is the idea of intrusive bodies of sulphides analogous to the intrusive masses of ordinary igneous rocks. Many Norwegian occurrences are explained in this way, as are the ores of Rio Tinto, Agordo and several minor ones on the continent. Differences of opinion will certainly arise on these points, but it will be stimulating and instructive for upholders of opposing views to read these pages with care.

The discussion of terrestrial nickel-irons, of platinum and of such occurrences of copper and gold as have been referred to direct crystallization from magmas, terminate this general chapter. There are not many good cases of the last two.

In the ore deposits of contact origin an old-time theme is next taken up, but one which has proven to be of exceptional interest in later years. They seem to have been first emphasized by v. Cotta and then the "Kristiania type" was later specifically established by v. Groddeck; but the phenomena themselves have received especially illuminating treatment in this country by Lindgren, Ransome, Weed and Barrell. The characteristic ores are magnetites and originally low-grade deposits of sulphides with copper, which may be enriched by secondary processes. These latter deposits are of extraordinary interest and significance and are passed in review in brief accounts of world-wide occurrences. The contact zones which yield tin afford a continuation and yet a variation of the original theme, in that limestones are no longer almost the only wall rock.

From the contacts we pass to the great subject of the veins—with which we find included, the cavity fillings of irregular form; and the replacements. Of this comprehensive division of ore deposits only two main types are treated in this volume, viz., the tin veins and the quicksilver veins. The former are naturally taken up next after contact zones, since to an extent unequaled by other types they show the results of pneumatolytic agents. With no metal so constantly as with tin do we find the boron and fluorine minerals, and no other veins appear in such intimate genetic relations with intrusive granites. The "granite-juice" surely exuded in order to bring about their formation. The discussion of tin deposits has also unusual historic interest in that it brings to the fore Cornwall, the mother-land of mining for the English-speaking world, and the famous old tin districts of Saxony and the bordering kingdoms, which have played the same role for the German-speaking miners. Tin is, however, brought today chiefly from the Far East, and in the pages before us the reader will find extremely interesting descriptions, especially of the Malayan placers, which are illustrated by new and excellent pictures.

TWO TYPES OF QUICKSILVER VEINS

The quicksilver veins are divided at the outset into two contrasted types, the cinnabar and the fahlerz, or as we would say the "gray copper." The former is much the most important but the latter is not to be overlooked and may indeed be present in depth below cinnabar above. In the development of our views regarding the general precipitation of vein fillings, the cinnabar deposits have been of exceptional significance. The California and Nevada cases in which the process is proceeding right before our eyes, have furnished sure and tangible ground on which to establish general doctrines. The close association of these ores with recent volcanic activity elsewhere has further strengthened our faith in hot springs and similar thermal agents. Our authors are alive to these important relations and in the general introduction make them clear. Following this the producing regions are passed in review. Excellent indexes then conclude the volume.

The second part of Vol. 1, as will be seen from this review, maintains the high standard of the first. It happens to contain matter that treats especially of the newer views and doctrines of students of the subject, and will prove stimulating and instructive to all who read it.

J. F. KEMP.

The Calumet & Hecla Consolidation

The directors of the Calumet & Hecla company have issued a circular letter, replying to the more important criticisms of their plan that have been made. Interesting statements in this letter are the following:

The conglomerate lode of the Calumet & Hecla can yield at the present rate of production for about 15 years; after that, six or seven years of a lessened production will exhaust this lode. The life of this mine can be estimated with more accuracy than that of any other included in the proposed consolidation, except the south branch of the Osceola, which can maintain its present rate of production for four or five years, after which it will be entirely exhausted by one year more of greatly lessened production.

Mr. Channing, in making his report, was employed and was paid by all the companies, and was asked to make an impartial investigation. In a dispatch from Globe, Arizona, under date of Feb. 17, Mr. Channing indignantly repudiates the references by Thomas L. Chadbourne, stating that in his valuation of these properties he knew neither one side nor the other, past records and future prospects being his only guides. Mr. Channing states further that the Calumet & Hecla conglomerate is practically blocked out by shafts and drifts, and its value is known, whereas Ahmeek was given credit for an enormous tonnage of ore that no one has yet seen, the value of which can be determined only by taking into consideration the history of the district.

Mount Morgan

Interest in the report of the Mount Morgan Gold Mining Company for the half year ended May 31, 1910, centers chiefly in the changes brought about by the opening of Many Peaks mine. The Many Peaks ore is cupriferous pyrite, and is used as flux to replace the barren iron ore formerly used. The changes are best shown in an accompanying table.

FURNACE CHARGE PER TON OF FINE COPPER—MOUNT MORGAN.

	Tons Year Ended May 31, 1910.	Tons Recent Practice.
Mount Morgan ore	32.97	22.76
Many Peaks ore	.....	9.29
Limestone	17.60	9.96
Iron ore	7.15	0.88
Converter linings	0.92	1.54
Coke	5.50	3.82

There are three furnaces at work, two on ore smelting, the third on matte concentration. Extra blowers are being installed, so that a fourth furnace can be operated, which will increase production by about six tons of blister per day and diminish costs. About 600 tons of Mount Morgan and from 250 to 300 tons of Many Peaks ore will then be smelted daily. At present the sulphur elimination is about 80 per cent. in the first smelting. From 90 to 92 per cent. elimination would be required to give a matte high enough to convert direct. Many other improvements were made in the smelting plant, such as larger forehearths, a new jacket-water circulating system, new converters, etc.

Leaching is still practised on some of the sulphide gold ores, the production in the six months under review by this process being 25,922 oz. gold and 259 tons of copper. This was obtained from the treatment of 59,620 tons of ore.

The ore reserves in the Many Peaks mine are estimated at 840,000 tons carrying about 2.46 per cent. copper, besides a large undefined body carrying about 1.5 per cent. This will all be available, as it will be used for iron flux. No statement is made of the reserves in the other mines. A 5 per cent. dividend was paid in the six months covered by the report, besides allowances for depreciation.

[NOTE—Since its organization, Oct. 1, 1886, this company has paid about 725 per cent. on its capitalization.—EDITOR.]

Magdalena Mining District, New Mexico

BY L. P. PRESSLER*

The Tri-Bullion Smelting and Development Company has recently made extensive repairs to the milling plant, thereby increasing the capacity to 100 tons per day, which has put more activity into the mining operations. This property is the largest producer in the district. The lessee's on the Carbonate zone have curtailed shipments as the smelteries taking these ores have a surplus on hand. The Tri-Bullion company has let a contract for an additional 50 ft. of the main shaft on the Grand Tower claim. With this increased depth they expect to encounter another body of zinc-sulphide ore which had been cut off by a dike.

The Germany Mining and Development Company is continuing the crosscut and the heading is nearing the ore-producing zone. It has a large area of ground in the district.

The Mistletoe company is driving a crosscut to the south of Kelly on its newly acquired Lynchburg claims. This will open up an entirely undeveloped area.

The Ozark Smelting and Mining Company is still experimenting with a process for milling the ore, this time trying out the flotation process, and so far has met with good results. No doubt it will soon erect a plant to try out this method thoroughly as it has a large body of low-grade zinc sulphide ore blocked out. This company has a few men at work on the Mitchell tunnel, developing the upper part of the mountain side and has opened a body of lead-zinc sulphide ore. There are many prospectors exploring the gold and silver deposits to the north and south of Kelly.

*Mining engineer, Magdalena, N. M.

Idaho Metal Production

According to the report of the State Mine Inspector the production of the mines of Idaho in 1910 was as follows, the figures for the Cœur d'Alene district being given in brackets: Gold, 49,289 oz. (3110); silver, 7,890,388 (7,262,271); lead, 119,572 tons (114,975); copper, 5,837,639 (5,003,639); zinc, 5,995,600 lb. (5,995,600).

These figures show that the mining industry outside of the Cœur d'Alene was of relatively small account, save for the lead mines at Gilmore, Lemhi county, and gold mines in several counties.

Features of interest in the report are the statements that the Bunker Hill & Sullivan lode is showing remarkable persistence, that the Morning mine is developing a better grade of ore at a lower horizon, that the Snowstorm copper mine has been bottomed, and that the lead-silver mines at Gilmore are of good promise.

First National

The First National Copper Company in 1910 produced 9,911,451 lb. of copper, 456,487 oz. of silver and 10,389 oz. of gold. Balaklala ore was the source of 8,451,653 lb. of the copper, the remainder coming from ore received from the Bully Hill and Mountain companies. Owing to the troubles resulting from the smoke litigation, the operations of the year resulted in a deficit. The copper product fetched a little better than 12½c. per lb., while the direct cost was a little more than 11c. per lb., but operating profit was more than wiped out by the expenditure of upward of $100,000 on the Cottrell plant and other experimental expenditures. The Cottrell system is said to be now eliminating between 70 and 80 per cent. of the solids from the smoke. The company is operating one blast furnace and one reverberatory. The company is said to have put more ore in sight than was mined in 1910 and to have now developed about 2,000,000 tons, averaging 2½ per cent. copper and $1 per ton in gold and silver.

United Verde

In 1910 the United Verde Copper Company produced 38,663,800 lb. of copper, 563,133 oz. of silver and 19,267 oz. of gold. The corresponding figures for 1909 were 36,694,063; 495,480; 17,022. The sales of copper in 1910 yielded $4,906,984 against $4,762,448 in 1909, these amounts per pound of copper being 12.69 and 12.97c. respectively.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Mark R. Lamb will return from South America in March.

H. E. Vautelet has resigned his position as a member of the Quebec Bridge Commission.

H. V. Winchell is in Mexico on professional work. He expects to return early in March.

B. B. Thayer has gone to Butte on a trip of inspection and will be absent for about five weeks.

Edward W. Parker, statistician of the U. S. Geological Survey, has been visiting the Pacific coast.

Prof. Willet G. Miller, provincial geologist of Ontario, has returned to Toronto from New York.

Francis Church Lincoln is leaving New York this week to make some mine examinations in the Southwestern States and Mexico.

J. Parke Channing is expected to return from Arizona about March 15, by which time it is believed that the Miami will be in operation.

John Hays Hammond, it is announced, will be special ambassador to represent the United States at the coronation of George V of England.

Joseph E. Davis, late of St. Louis, has been appointed director of the Wisconsin Mining School, at Platteville, Wis., in place of H. E. George, resigned.

W. C. Fownes, Jr., has been elected president of the Pittsburg Crucible Steel Company; John W. Dougherty has been chosen vice-president and general manager.

Stewart Thorne, late manager of the Peterson Lake mine, Cobalt, has accepted the position of manager of the Preston East Dome Company, Porcupine, Ontario.

William Burlingham has been chosen president of the Burlingham Coal Company, of West Virginia. He was recently connected with the Chesapeake & Ohio Coal and Coke Company.

William H. Goadby, chairman of the board of directors of the Sloss-Sheffield Steel and Iron Company, is in the Birmingham district in Alabama, inspecting the plants of the company.

Alexander Leggat left Butte, Mont., Feb. 17, on his way to examine properties in the Bill Williams country, Mohave county, Arizona. His temporary address will be Bouse, Arizona.

Hubert Merriweather, recently mine superintendent of the Juragua Iron Company, of Firmeza, Cuba, has been appointed general superintendent of the company in place of E. M. Holmes, deceased.

T. K. Maher, president of the Belmont Coal Company, has been chosen president of the Eastern Ohio Operators Association, while C. E. Maurer, president of the Glens Run Coal Company, has been made vice-president.

OBITUARY

Raymond W. Nutting, engineer of the Aporoma Goldfields, Ltd., at Sandia, Peru, was killed recently by falling from a cliff near the mines. He was a graduate of Cornell University and before going to Peru was employed as an engineer in the construction of the McAdoo tunnels under the Hudson at New York.

E. M. Holmes, general superintendent of the Juragua Iron Company, at Firmeza, Cuba, and formerly assistant general superintendent of the Spanish-American Iron Company, at Daiquiri, Cuba, died at Firmeza, on Feb. 11, of diabetes. He was an associate member of the American Society of Civil Engineers, member of the American Institute of Mining Engineers, and member of the American Society of Engineering Contractors.

William Kennedy Fleming, who for the past 11 years had been private secretary to Chairman E. H. Gary, of the board of directors of the United States Steel Corporation, died, Feb. 17, at East Orange, N. J. He was 47 years old, was born in Brantford, Conn., and graduated from Harvard University. Mr. Fleming, in the performance of his duties, had regularly come in contact with the leading iron and steel makers of the country and he was well known throughout the trade.

Godfrey Weerts died at Lasalle, Ill., Feb. 4, 1911. He had been the general manager of the Matthiessen & Hegeler Zinc Company for many years and had been connected continuously with that company since 1866, which is to say almost from the beginning. Modest and unpretentious, seldom figuring in the newspapers, he was a thorough master of the zinc-smelting business and was an able adjunct to his distinguished chiefs at the head of the great company which he served so long and so well. His sterling merit was appreciated outside of his own circle and many friends will learn of his death with profound sorrow.

SOCIETIES and TECHNICAL SCHOOLS

American Institute of Mining Engineers—At the annual meeting of the corporation in New York, Feb. 21, Charles Kirchhoff, of New York, was elected president of the council. Dr. R. W. Raymond, of New York, was reëlected secretary of the council.

American Society of Mechanical Engineers—The sixty-third meeting of the society will be held in Pittsburg, Penn., May 30 to June 2, inclusive. The society has not met in that city since 1884. An executive committee consisting of E. M. Herr, chairman; George Mests, J. M. Tate, Jr., Chester B. Albree, D. F. Crawford, Morris Knowles and Elmer K. Hiles, secretary, will have charge of the Pittsburg meetings.

American Institute of Consulting Engineers—At a meeting of the council, held Feb. 24, it was decided to oppose all the bills now pending in the Legislature at Albany to license civil engineers. President Boller and the Committee on Legislation of the Institute were instructed to attend the hearings on these bills at Albany, and to use all legitimate means to prevent their passage; also to coöperate with other engineering bodies having a like object in view.

Michigan College of Mines—The Minnesota alumni. of the college met at Virginia, Minn., Feb. 22, for their fourth annual dinner. A. P. Benson was toastmaster. There are 47 alumni in the State and of those 31 were present. Professors F. W. McNair and James Fisher were the guests of honor. At the business meeting William Wearne was chosen president; B. A. Middlemiss, vice-president; A. L. Gerry, secretary and treasurer. It was decided to hold the next meeting at Hibbing.

International Steel Conference—An international meeting of iron and steel manufacturers, similar to that held in New York in October, 1910, will be held in Brussels, Belgium, beginning July 5, 1911. A delegation of steel manufacturers representing the American Iron and Steel Institute will attend. It is expected that the iron and steel interests of Great Britian, Germany, France, Belgium, Austria-Hungary, Italy, Spain and Russia will also be represented. The organization which is now being formed will be known as the International Iron and Steel Institute.

Massachussetts Institute of Technology—A Congress of Technology will be held in Boston on April 10-11, in celebration of the fiftieth anniversary of the granting of the charter of the Massachusetts Institute of Technology. In line with this idea, the 50 or more papers, which will be presented at the congress will be written by graduates of the Institute, and will thus serve to record the part the alumni of the institution have taken in the development of scientific industry. As the titles of these papers are sent in by the writers it is becoming evident that the managers of the congress will succeed in their effort to make the proceedings show from another point of view the general industrial advance that has taken place during the past 50 years under the guidance of the trained engineers. The papers will cover a wide range of subjects, from architecture to sewage purification.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

Feb. 22—The first consignment of steel to be used by Moore & Scott, San Francisco, in the construction of two dredgers has arrived at the Oakland yards of the company. These dredgers are to be sent to Alaska for the Yukon Gold Dredging Company, and are to be completed in May next. They are said to be the first of the kind constructed in the West, with steel hull. The length of each is to be 93 ft.; beam, 38 ft.; depth, 8 ft.; they will be operated by electricity and have a bucket capacity of about 15 cu.ft. The economy of building dredgers in California for service in Alaska is apparent, and others will probably be built in yards in this vicinity.

Dredge mining raised Sacramento county to fifth in the rank of gold production in the State in 1909, the production, according to the U. S. Geological Survey, being $1,669,814, an increase of more than $500,000 over 1908. From other estimates the dredge operations are said to represent about $1,600,000 in 1909, and to have largely increased in 1910. The dredge-mining district is on the American river, comprising about 12,500,000 acres, of which in 1909 more than 6,000,000 acres had been proved dredgeable, 5,621,000 of which was owned by the Natomas Consolidated of California. This company is adding a 50-ft. extension to the machine shops at Natoma, thus increasing the capacity about 50 per cent.

Complaint is made to the Anti-Débris Association that quartz miners in Amador county are dumping material into Jackson and Dry creeks. The association has confined its efforts to violations of hydraulic and dredge miners, but agreed to investigate the complaints of Charles W. Landers and C. C. Prouty, whose lands in the southeastern part of Sacramento county are said to be affected.

There have been numerous bills introduced in the present legislature looking to the advancement of the mining industry or the curing of evils, but nothing definite has been accomplished. The bill for the appointment of a mine inspector has been amended in the Senate committee by increasing the compensation of the inspector from $2400 to $3600 per year, but providing for one deputy instead of two. A bill for the conservation of natural gas, providing for the capping of gas wells is also under consideration. Should this bill become a law and properly enforced, it should effect the conservation of many millions of cubic feet of gas, and aid in making the product a profitable commodity. But the capping and controlling of gas wells is a physical operation that will meet with obstacles similar to the controlling of water infiltration. Another bill looking to the benefit of the mining industry includes the conservation of various natural resources. Putting all together there is possibility that by the conclusion of the legislature something may be done that will add to the economy and the profit of mining in California. The greatest anxiety, however, respecting legislation is centered on the oil-placer bill in the Congress, as the straightening out of the placer-patent laws is the most important of all the needs of the mining people of the State.

Denver

Feb. 23—At the annual banquet of the Boulder Metal Mining Association, Victor Alderson, head of the State School of Mines, in the course of his speech touched on the building of the new mill by the Association mill company, and said that a few successful years of wet treatment of ore in Boulder county would make the production of gold and silver equal to that of tungsten, and added that the wet method of treatment of ore at local mills was fast taking the place of smelting.

The *supersedeas* applied for by the striking coal miners of the Northern fields who were sent to jail for one year by Judge Greeley Whitford, was denied by the Supreme Court which sustained him, holding that he rightly assumed jurisdiction in the case. The merits of the contempt cases were not touched upon.

The Pay Day mine, in the La Plata district, and locally known as the Idaho, asked the Federal court to grant an injunction against the Valley View Consolidated Gold Mining Company, forbidding it operating further on the Valley View vein, which it was claimed apexed on the Pay Day ground. Under the decision handed down by Judge John A. Riner, in the United States District Court on Feb. 20, the Valley View can resume operations and ore to the value of $75,000 held at the Durango smeltery is released.

The Valley View is a marvelously rich mine and since September, 1910, has disbursed 4 per cent. monthly dividends on its capital of $1,000,000. It is stated that one carload of the ore realized $34,000, and that the average of the 1910 shipment was $3000 per carload. Some selected ore contained as high as 600 oz. gold and 5000 oz. silver per ton.

At Trull, in Routt county, on the Elk river, just above where it empties into the Bear or Yampa river, a well was sunk some eight years ago at the side of the road and close to the bridge. A reliable and well known citizen of Steamboat Springs happened to be in the vicinity, and a man came to him with news that oil had been struck. So he went to the spot and saw the oil where it had flowed across the road. Work had stopped on the well that day, but a man was kept there in charge of the machinery for several years afterward; why, nobody knows, except that they were waiting for the railroad. Now, however, it is stated that the Oklahoma Oil and Gas Company, with H. C. Berwind as its representative, is taking leases from the Trull ranchmen, and will sink wells as soon as machinery is installed. This is at the eastern edge of the Yampa coalfield and all the indications for oil are promising.

The Colorado chapter of the Mining Congress held a meeting this week at which several measures now before the legislative assembly were considered. Among them was a bill for an appropriation of $100,000 for the purpose of completing the ore-testing plant at the Colorado School of Mines, for which $75,000 has already been appropriated. The plant as well as being for the use of the students, is to be at the disposal of all mining men and mining districts of the State for determining the treatment of complex ores. Other bills under consideration were, one on mine taxation, one on drainage districts, and another on enlarging mining claims to 600 ft. in width.

Butte

Feb. 23—Louis Seasongood, of Cincinnati, owner of 25 shares of stock in the Boston & Montana mining company, has filed in the local district court his objections to the dissolution of that company. It is stated that the stockholders' meeting, at which it was voted to sell all the company's property to the Anaconda company, was not legally held and that the objector had no opportunity to be heard in the matter. The whole action was merely in furtherance of a scheme to acquire the Boston & Montana assets at a grossly inadequate figure, and in support of this contention it is stated that at the time of the sale the Boston &

Montana company, with a capital of $3,700,000, had a surplus of $7,389,280, while the Anaconda company with a capital of $30,000,000, had a surplus of only $4,966,353. The objector states that during the 12 years he has held his 25 shares of the Boston & Montana stock he has received $9125 in dividends, whereas the Anaconda company is only paying yearly dividends at the rate of $2 per share.

In anticipation of the annual meeting of stockholders of the Barnes-King company to be held at Lewistown, March 1, a committee of stockholders has sent out proxies soliciting votes for C. W. Goodale, John E. Corette and John H. Kirk, as directors. The committee later states that there should be elected a board of Western men as directors, so that those familiar with actual conditions existing here may have a voice in the future plans of the company. The three men named are residents of Butte.

Salt Lake City

Feb. 23—Mining conditions are improved in a number of Utah camps, and preparations for an increased output are being made in Bingham, Park City and Tintic. Most of the mining and smelting companies are better equipped to handle their output than they were last year, and there promises to be an increase in the tonnages shipped to the Valley smelteries.

The Utah Copper Company will soon have its milling plants in shape to handle 20,000 tons daily. There are 21 steam shovels now on the property, of which 15 are in continuous operation. Five of these are removing the overburden on the upper benches of the Boston Consolidated territory, and nine shovels are at work on Utah Copper ground, two on ore, and seven in capping. Underground mining is also being done on the Boston Consolidated side, and drilling operations are still being carried on. The Bingham & Garfield railway is expected to be operating by the middle of the year; steel for the trestles is on the ground, and two of the towers for the main trestle across Carr fork have been started. Much activity is promised at the Utah Apex, Bingham-New Haven, and other Bingham properties.

At Park City extensive development work has been in progress, and several mines are expected to increase their output. Operations will be started on an extensive scale, in removing and milling the old stope filling from the Ontario mine.

New discoveries of ore have been made, particularly in Tintic. The Iron Blossom and Uncle Sam Consolidated have increased shipments, and the Beck Tunnel will soon start to ship from the ore recently encountered. Strikes have also been made in other properties, and a number of mines are increasing production. There has been an average advance of 15 per cent. in the local stock market since Jan. 1. The general outlook is conservatively optimistic.

Indianapolis

Feb. 27—The Indiana coal operators are strongly opposed to the Miners' Qualification bill which has passed the lower house of the Legislature. An effort will be made to amend the bill in the Senate. They object to that provision of the bill which provides for the membership of the board which is to have the examining power. The bill provides for a board consisting of two miners and one operator. This, they say, will be equivalent to a miners' board since the operators would be in the minority at all times, when a difference of opinion might develop.

They say the miners might exclude men of the highest qualifications or admit anyone they saw fit to the privilege of working in the mines. The right of appeal to the circuit court is of no value as the court has no power to give the man another examination. They ask that the bill be amended so as to provide for an impartial board of examiners, consisting of one miner, one operator and one of the State mine inspectors for each county. As the bill passed the house the examinations are to be in the English language. This would exclude foreigners who now seek work in the mines. The Senate committee, however, has amended the bill so as to provide for the services of an interpretor.

The shot-firers' bill was amended so often and so disfigured that the author of the measure withdrew it before a final vote was taken in the Senate.

Cobalt

Feb. 24—It is announced that Bewick, Moreing & Co., has secured options on 50 claims, belonging to the Timmins, McMartin and Dunlap syndicate, in Porcupine. These are apart from the Hollinger and Miller-Middleton properties, which the syndicate still controls. These properties are practically undeveloped, but are in good areas and in close proximity to working mines. The company's engineers will proceed at once to open up the claims and it is stated that provision for an expenditure of $500,000, has been made. The entrance of this firm into the district will be an extremely good thing for Porcupine as it will insure the opening of new territory under sane and conservative management.

A stampede of prospectors has set in from Porcupine, south into the Sudbury division where new gold discoveries are reported to have been made. The new find is near Muskesenda lake, just south of the township of Bartlett, and forty miles from Porcupine. Some of the samples brought in were extremely rich.

Sir James Whitney, speaking to the Ontario legislature a few days ago, stated that an important announcement would shortly be made with regard to the Temiskaming & Northern Ontario Railway. It is believed that further extensions of the line are to be built in Ontario, and that a line may be built right through to Sudbury. This would be of great importance to the mining industry of this country as it would undoubtedly open new districts that are rich in mineral resources. Good progress is being made with the railroad extension and there are now about 900 men at work. The operations are considerably handicapped on account of the depth of the snow, there being almost four feet of it.

San Luis Potosi

Feb. 27—Clive Cookson, one of the principals of Cookson & Co., lead and antimony refiners of Newcastle-on-Tyne, England, will arrive in Mexico shortly on business connected with the extensive interests of the concern in this republic. The Cooksons hope to soon close a contract with the Towne smeltery at San Luis Potosi for its lead bullion, which now goes to the United States. They have been buying the lead output of the Torreon smeltery for several years, Hamburg-American steamers carrying the bullion from Tampico to England. The Torreon smeltery has notified the Cooksons that beginning with March its lead output will be considerably increased, due to its contract for the output of the Naica mines, of the Compañia Minera de Naica, in the Naica camp of Chihuahua. This Mexican concern recently abandoned plans for building a smeltery, and signed a long-term contract with the Torreon smeltery. Several hundred tons of lead-silver ore will be delivered to that plant daily. The Cooksons own antimony mines in the states of San Luis Potosi and Queretaro, and operate an antimony smeltery at Wadley, a station on the National Railway, in San Luis Potosi. The properties were purchased several years ago from M. Elsasser and A. Weill, of Mexico City, the English refiners paying £160,000. Shipments of antimony from the Wadley smeltery amount to hundreds of tons monthly, the product going through the port of Tampico. All of the properties are near transportation, with the exception of those at Santa Maria de Miera, state of Queretaro, which are about 100 km. distant from Bernal station. Gas-engine trains, recently purchased in England, will soon replace mule trains in the transportation of ore to Bernal. The Cooksons are also interested in oil lands in the state of Veracruz.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

It is proposed to drive a tunnel through the divide which separates Fairbanks, Cleary and Gilmore creeks for the purpose of finding the source from which the placer gold in these streams came. The citizens of Fairbanks have subscribed $50,000 to carry on the work.

Recent strikes in the Tulaksak River territory have disclosed rich ore. Machinery will be sent to the district this spring.

Crow Creek Consolidated—E. J. Barnes, Seward, has sold this mine. It will probably be equipped with machinery in the near future.

Alaska-Mexican—For the month ended Jan. 15, the mill ran 29¾ days; crushed 18,129 tons of ore; produced $65,747, at a cost of $33,209. For construction work $4072 was spent. The yield per ton milled was $3.77 in bullion and concentrate.

Alaska-United—During the month ended Jan. 15, the mills ran 29¾ days; crushed 35,099 tons of ore that yielded $63,470, at a cost of $52,336. For construction work $4211 was spent. The yield per ton of ore was $1.92.

Alaska-Treadwell—During the month ended Jan. 15, the mills ran 29½ days, crushed 49,028 tons of ore yielding $122,275, at a cost of $82,059. Construction expenses were $18,248. The yield per ton of ore was $2.61.

Arizona

About 100 men are now engaged at placer mining in Weaver Gulch.

Cochise County

Cochise Gold Company—A 500-ton cyanide plant is being planned for this mine in the Dragoon mountains near Phœnix.

Gila County

Miami—Although the final details of the mine and mill equipment are reaching completion with gratifying expedition, it is nevertheless uncertain that the mill will be ready for operation as early as March 1. At the mine everything is ready for extraction of ore. The ore pocket at the south side of the main shaft (No. 4) is almost completed, the chutes leading from the laterals to the rooms that will first be worked are in place, the breaking of the orebody above has begun, the cables have been wound on the drums of the hoisting engine and the skips have been hung. The electric locomotives will be lowered into the mine as soon as the big cage has been hung in shaft No. 4. The cable will be wound upon the engine that will be used to hoist men as soon as the smaller one that was temporarily used at the shaft has been moved away. The new engine will lift a cage capable of holding 30 men without crowding. It is equipped with gates and the usual safety appliances. At the concentrator the work of reducing stiffness of the bearings of the new machinery is now confined to sections of unit No. 2. The power plant is not yet furnishing energy for operation of the mill and the small generator at the concentrator can run only a portion of one unit at a time. At the power plant the units are still being tested. The slight setback occasioned by an imperfect casting in one of the generators has been temporarily repaired and it is being used until the new casting arrives. All the pipe needed for completion of the water line from the pumping station at Burch to the mill is not yet here, but the management expects to complete it temporarily by using 8-in. casing until the remainder of the 14-in. pipe arrives. The 8-in. pipe is now laid. The spur from the main track in Miami has been completed to the concentrate storage bins west of the power plant. Several smaller spurs or side tracks have been added for accommodation of oil cars and other supplies. The supply tramway from the town of Miami to the mines and concentrator is completed.

Superior & Boston—The management expects to have the north station on the 1000-ft. level finished shortly after March 1; one pump will be installed. The installation of the water column and other pipe will be begun this week in the shaft between the sixth and eighth levels.

Inspiration—The Colorado shaft has reached the 500-ft. station of the Joe Bush shaft. Station cutting will be begun immediately, a 25-ft. sump and an ore pocket will be cut, and drifting to connect with the Joe Bush shaft will then be started. The tunnel will be one of the passages of the main haulage level of the Inspiration workings. Four drills are now operating on the property. The generator that will furnish power for the electric locomotives to be used in moving the ore from the shafts, as well as for the lighting system, has not yet arrived, but is expected daily. The test mill is handling about 20 tons of ore daily with satisfactory results, and various makes of tables and other machinery are being tested. The company is preparing a report that will be submitted in the near future.

Live Oak—Churn drill hole No. 49, on the southeastern section of the property, in which the drill penetrated the ore at 20 ft. from the surface, has reached a depth of 243 ft. and is still in ore. Hole No. 44, 200 ft. from the eastern side line of the Barney property, probably will be discontinued within a few days. The result of the drilling at this point has not yet been made public. Hole No. 45 is down 345 ft. and has not yet passed through the surface capping. Drill hole No. 47, being sunk on the southern line of the property, is 398 ft. deep and still in the surface formation. Hole 50, started last week, on the southwestern portion of the property, has made good progress, having reached the 360-ft. mark. In this portion of the property the orebody lies at a much greater depth. Considerable drilling will be required yet to reach the ore zone.

Warrior—The company continues the daily shipment of 125 tons of 10 per cent. ore to the El Paso smeltery. The new wagon road to the side track at Black Warrior switch is completed. General Manager E. M. McCarthy is expected to return from the East, March 1.

Orphan—The churn drill ordered by General Manager Clark, of the Orphan Copper Company, has not yet arrived, but a recent communication from the manufacturers is to the effect that the machine will be on the ground about March 15.

Copper Reef—It is expected that the 500-ft. level of the North Star inclined shaft will be reached during the coming week; when that depth is reached a station will be cut and crosscutting started to intersect the California vein and the other vein recently encountered at a depth of 475 ft. The California shaft has not yet cut the vein, although the management expects to encounter the lode within the next few feet.

Old Dominion—The Old Dominion spur being built from the smeltery to a point on the Arizona Eastern railroad in the city of Globe, is to be laid on heavy concrete piers. The latter are being built as rapidly as a large force of men can erect them.

MARICOPA COUNTY

W. A. Bondurant, of Los Angeles, is operating a mine and 10-stamp mill in the Cave Creek district north of Phœnix.

MOHAVE COUNTY

Nighthawk—New machinery will be installed at this Kingman mine.

Tom Reed—This mine near Kingman shipped in February, a 242-lb. gold bar worth $60,000, the clean-up after a three weeks' run of the 10-stamp mill.

YAVAPAI COUNTY

Germania—The shaft has reached a depth of 68 ft. and is in sulphide ore at this gold mine near Walker.

Haynes Copper Company—At this mine at Jerome operations will be resumed and the shaft sunk from the 700- to 1000-ft. level.

California

AMADOR COUNTY

Edward Records, of Oakland, has filed notices appropriating 100,000 in. of water in four branches of Sutter creek to be conserved in a reservoir to be constructed in Volcano basin. The announced intention is to use the water for mining and other power purposes in Amador, Calaveras, Sacramento and San Joaquin counties.

Zelia—The 40-stamp mill is again in operation after a short shutdown necessitated by the late heavy rains which filled the mine.

BUTTE COUNTY

Suit for $150,000 damages has been brought by the P. B. Steifer Mining Company against the Oro Water, Light and Power Company and others on account of breaking of the Philbrook dam in January, 1909, causing destruction of the pumping and the hydroelectric plants on the plaintiff's mine, near Magalia.

Big Blue Lead—This mine, near Bangor, is reported closed. Superintendent Young has bonded the Robbers' Roost, at Nimshew, which he will operate.

CALAVERAS COUNTY

The damage suit for $150,000 against the Lightner Mining Company, at Angels Camp, by James V. Coleman, of San Francisco, has been in progress at San Andreas three weeks and only about one-half the evidence adduced. The ground from which Coleman alleges ores have been unlawfully taken is the old Billings claim, located in 1866, but not recorded, afterward acquired and occupied as a town lot with the superintendent's residence by the defendant. The claim has been worked under the building and into the cellar, but defendant alleges that the ore did not pay for mining and milling; also that the apex is within Lightner ground, though the greater area of the claim is within the Angels mine, the property of the plaintiff.

Lightner—The three-compartment shaft has reached 345-ft level; 20 stamps will be ready to drop about March 1; the other 40 stamps within 30 days.

HUMBOLDT COUNTY

Klamath River Mining Company—C. A. Sample, president of this company, operating near Weitchpec, reports a face of 80 ft. of gravel.

MARIPOSA COUNTY

Exchequer Mining and Power Company—This company will build a new electric power house.

Mountain King—The flume that feeds the 40-stamp mill was put out of commission by the recent flood in Merced river cañon.

Mt. Gaines—The mine, at Hornitos, in the Quartzburg district, will be partly closed until electric power is again available.

NEVADA COUNTY

Delhi—Underground work is resumed at this mine, near North Columbia. Hamilton Eddy, superintendent.

Murchie—This mine, at Nevada City, cleared of litigation, has been sold to John J. Meyers and C. F. Humphrey.

RIVERSIDE COUNTY

Riverside Gold Mining and Milling Company—A ledge of gold and copper ore is reported to have been opened. J. M. McMillan, Chloride, Ariz., manager.

SAN BERNARDINO COUNTY

Gold Bug Mine—The 5-stamp mill is crushing ores from this mine and some custom shipments. Barney Osdick, of Johannesburg, owner, is installing a cyanide plant.

California-Trona Company—Drilling of wells in Borax lake is to be increased by the addition of a second engine and rig. C. F. Dolbear, manager.

Annex—This claim, adjoining the Yellow Aster on the southeast, has milled some medium-grade ore at the Osdick mill, at Johannesburg.

Mojave—This old mine is reported to have been sold to an eastern syndicate, represented by H. Chapman Williams, Cleveland, Ohio. New equipment, including a 40-stamp mill, is to be erected.

SHASTA COUNTY

Washington—An option is said to have been taken on this old gold producer, near French gulch.

Shasta-May Blossom—Twenty men are at work at this copper mine. William Wright, superintendent.

SISKIYOU COUNTY

Osgood—Development work encourages Superintendent Harrison to state that a large force will be put at work in the spring, and that the erection of a stamp mill is contemplated.

Colorado

CLEAR CREEK COUNTY

Hoosac—It is claimed that 2 ft. of copper ore has been opened in the tunnel.

Stanley Mine—Superintendent Jesse May employs 25 men and two cars of concentrates and ore are shipped weekly.

GILPIN COUNTY

Frontenac-Aduddel—The 250-ton concentrator is now in operation and said to be making a satisfactory saving. The ore from the Topeka mine is being treated at the Iron City mill. Henry P. Lowe is manager of both mines and mills.

LAKE COUNTY—LEADVILLE

A gold-bearing fissure vein in the porphyry and granite was recently opened in the Rockfeller group in Big Evans gulch. The country is seamed with fissure veins and offers exceptional opportunities to the miner and prospector.

St. Louis—The Kezar Mining Company, controlling this mine, is working on a streak of ore at the south end of the claim. The shaft, which is 350 ft. below the tunnel level, will be sunk another 150 ft.

Garbutt—Lessees on this property have obtained permission to run a drift from the No. 4 shaft of the Little Jonny to cut their shaft 200 ft. deeper.

Matchless—About 30 tons of silicious iron ore is being shipped daily from this Fryer Hill property by Raney & Newman, lessees.

Dunkin—The lessees of this Fryer Hill mine are shipping silver-lead ore daily.

PITKIN COUNTY

Smuggler—This mine, at Aspen, is again in operation.

SAN JUAN REGION

A snowslide carried away a 30-ft. tower of the aërial tram of the Silver Lake mine. A tower of the Iowa Tiger tram and cables and power lines are down. The mine and mill transformers were burnt out.

TELLER COUNTY

Comanche Plume—Heller & Richards, lessees, are operating through the Bonita tunnel and have made a trial shipment of ore.

Requa-Savage—A new body of ore has been found at this Beacon Hill mine.

American Eagles—From this property under lease to the Colorado Mines Investment Company three car loads of smelting ore were recently shipped.

Gold Sovereign—The Union Leasing Company will increase the working force.

Work—The dump of the Work Mining and Milling Company caved into the mine workings, through an open stope in Squaw gulch between Raven and Gold hills.

Idaho

High-grade copper ore has been discovered, by William Simpson at the base of Anderson butte on Crooked river, five miles from Elk City.

Coeur d'Alene District

Hunter—The ore in sight in this mine is estimated to be sufficient for five years. The company has paid only two dividends in 20 years operating.

Northern Light—The shaft now in galena ore at 30 ft. is to be sunk 200 feet.

Panhandle—A strike of high-grade ore has recently been made.

Morning—A flotation process of concentration is to be added to the mill, for retreating tailing.

Idaho-Continental—A force of 25 men is at work and ore has been cut in the lower tunnel.

Kansas

Bonanza—Henry Weyman, of Joplin, has purchased the Bonanza tract of 320 acres.

Badger—D. R. Goucher, of Carthage, has purchased 110 acres of mining land at Badger from R. M. Lane, of Tulsa, Okla., and Frank L. Williams, of Chicago, for $25,000.

Minnesota

Cuyuna Range

Inland Steel Company—This company is exploring three forties in the west half of the west half of Sec. 17- T 46- R 29, which it took under option, some time back, from Carlson Brothers. The company is finding some ore that will run a little over 55 per cent. in iron.

Rogers-Brown Ore Company—It is said that this company expects to have between 1600 and 1700 men working for it by May 1 on its properties in the vicinity of the towns of Crosby and Ironton. Recent developments at the company's Kennedy mine indicate that a larger tonnage will be developed at this property than was originally estimated. It seems that there are two distinct lenses of marketable ore available from this shaft. The majority of the underground work to date has been done on the north lens. However, some recent drifting on the south orebody shows that it contains a large tonnage of good ore. This is a favorable development, as it will undoubtedly increase the life of the mine to an appreciable extent.

Vermillion Range

Marquette & Vermillion Iron Company—This company has under option the southwest quarter of Sec. 19- T 62 R 14. The officers are Sam Simpson, of Minneapolis, president, John L. Morrison, secretary, and Edward M. Barrett, vice-president. Among the directors are Henry T. Stack and Richard J. Ryan. Some drilling has been done and the ore formation cut. The company expects soon to start some test-pitting work, in addition to the drilling.

Roy Development Company—This company is exploring the northwest quarter of Sec. 3- T 61- R 15. This property is east of the North American Company, and north of the Minnesota Steel and Iron Company's holdings. Some ili-directed and unprofitable drilling was done on this property some years ago, but the present company has sunk a shaft and is now engaged in crosscutting. The shaft is now about 100 ft. deep and has encountered the iron formation. Thomas Owen, of Two Harbors, J. C. McGreevy, manager, Louis Loeb and H. J. Grannis, of Duluth, are among those interested in the company.

White Lake Iron Company—This company is exploring the east half of the northeast quarter of Sec. 4- T 61- R 15, commonly known as La Chance claim; it adjoins the North American property on the east. James Le Brec is president of the company and has charge of the work in the field. Four holes have been drilled, one of which is over 700 ft. deep, and at that depth is in ore formation.

Missouri

Joplin District

Hackett—This company has had to remove its installation of Richards pulsator jigs from its 500-ton mill, as they would not handle the Joplin ores. The ordinary Joplin type of Cooley jigs are to be installed.

Mattes Brothers—This company has had seven drills prospecting on their land west of Joplin.

Nowata—This company has secured a 20-acre lease on the Baker land south of their Nowata No. 1, and have struck the extension of the run they are working in their mine.

Homestake & Mascot—Axel O. Ihlseng and associates have purchased these mines at Granby for the sum of $75,000. These two mines have produced over $2,000,000.

Granby—The custom mill was recently destroyed by fire. The company intends to erect another and larger mill.

Providence—The company has completed a new 500-ton mill on the Missouri Zinc-fields tract, near Webb City. The mill will be electrically driven throughout.

Excelsior—Ezra Allendorf has been elected general manager of this company as well as of the Moler Smith.

Melrose—The 300-ton mill at Porto Rico has been completed and is now operating.

Montana

Butte District

Anaconda—At the Mountain View mine a new bed is being placed under the main hoisting engine and the cylinders are being changed for the use of air. At the Gagnon mine the new vertical shaft is now down 1500 feet.

Butte Central—The shaft is being sunk from the 500- to the 1000-ft. level at the rate of 3 ft. a day.

Fergus County

Barker—Sixteen men are employed at the mine situated at the town of the same name. The ore contains gold, silver, copper and lead and is being shipped to the East Helena smeltery.

Alice and Winifred Group—It is planned to sink a 250-ft. shaft and if the orebody proves satisfactory a mill will be built.

Sanders County

Copper Cable—Burns & Graham are working this property 3 miles south of Plains. A tunnel has been driven 580 ft. and a vein encountered.

Granite County

Hobo—McLeod & McMillan recently struck a body of rich lead and silver ore, in this Hasmark district mine.

Jefferson County

Sunlight—Messrs. Farish and Josephi, mining engineers, New York, are making an examination of the mine for Eastern men.

Lincoln County

Hazel T.—The 3-ft. oreshoot discovered last fall has been drifted upon 70 ft. A new tunnel is being driven to cut the vein at greater depth. A contract has been entered into with the Libby Water Works and Power Company for a supply of power.

Madison County

Triangle Mining and Development Company—At a recent meeting of stockholders it was voted to increase the stock from $50,000, to $1,200,000 to provide a fund for development purposes.

Nevada

Nye County

The discovery of a deposit of tungsten ore in the Wingate Pass district is reported.

Nevada National—A new mill is to be built at this Millet mine.

White Pine County

Sims-Olsen—Development work on this tungsten mine is being paid for by ore produced. The best ore averaging 15 per cent. tungstic acid is being saved and will be shipped by teams in the spring.

Oregon

Coos County

Pulaski Coal and Navigation Company—This company, organized at Los Angeles, Cal., controls 300 acres of coal land near Coquilla and $75,000 will be expended for new machinery.

Pennsylvania

Bituminous Coal

Pittsburg-Buffalo Coal Company—A fire broke out in the Hazel mine of this company, near Canonsburg, on the morning of Feb. 26. Shortly after the fire was discovered in entry No. 37½ dip, about two miles under the hill, officials of the company at Pittsburg were notified and went to the scene the same afternoon. With 50 men, working in three shifts, they fought the fire and finally constructed walls on both sides of it. Water, carried through 18,000 ft. of hose, slowly drowned the flames and the fire was brought under control the next day. It is the third fire since the mine was opened 13 years ago. David G. Jones, general manager of the company, who had charge of the fire-fighting forces, with John H. Jones, president, was overcome by heat and smoke and had to be taken from the mine. He soon revived.

Utah

Beaver County

South Utah—Concentrates produced during January carried 9.88 per cent. copper, as compared to 10.46 per cent. in December, and 8.82 per cent. in October. Since operations were started in the reconstructed mill, 80,059 tons of ore have been treated, producing 7006 tons of concentrates, or concentrating between 11 and 12 into 1. The concentrates contained 1,259,917 lb. copper, 496 oz. gold, and 8128 oz. silver. During January, 22,090 tons of ore were treated, producing 2091 tons of concentrates.

Cedar-Talisman—A number of shipments of zinc and lead ore have been made since the first of the month. On the 400-ft. level from 2 to 6 ft. of silver-lead ore has been found.

Creole—Arrangements may be made to ship fluxing ore to the Valley smelters. The property is near Milford.

Moscow—Ore is being mined from the 142-ft. winze below the 400 level. It is proposed to sink the main working shaft from the 500- to the 600-ft. level, and then to drift for the vein.

Granite Copper—This company in the Mineral range, Granite district, is reported to be preparing to do work.

Noon Day—This group of claims in the Bradshaw district have been taken over by Minneapolis people. The property consisits of three claims and a fraction, and adjoins the Cave mine on the south. Arrangements are being made for installing equipment and beginning work.

Red Warrior—On account of the necessity of rehandling the ore under the present conditions, a crosscut is being driven for the orebody on the 500-ft. level, it will then be possible to do the hoisting in one operation.

Salt Lake County

Utah Metals—It is planned to issue new bonds guaranteed by this company for retiring the Bingham Central and Bingham Standard bonds, which are outstanding, the new bonds to run five years, and to be convertible into Utah Metals at $5 per share.

Utah Consolidated—Good progress is being made in sinking the new three-compartment shaft from the seventh level. Raising to meet the shaft will be done from the 10th level, and sinking from this level will also be carried on, while the above work is being done.

Bingham-New Haven—The report that a serious cave had occurred in the large orebody has been denied, and it is explained that one of the abandoned stopes had been allowed to cave, it being useless to keep the timbering in repair. Regular shipments are being maintained.

Ute Copper—This company owns the Winnemucca mill, recently taken under lease by Werner Ziegler. The mill is open to treat custom low-grade sulphide ores.

Utah Mines Coalition—The wreckage near the mouth of the tunnel, caused by the snowslide, will be cleared as soon as weather conditions permit; this will require about two weeks' work. New buildings will be constructed, and operations resumed as soon as possible.

South Hecla—Drifting is being done on a 4-ft. vein, 2 ft. of which are reported to be rich in silver and lead. This property is being considered in a proposed consolidation of Alta mines, but on what basis has not been given out.

Cardiff—Sulphide ore is reported to have been cut in the north drift, of the same character as found on the 250-ft. drift south, from which shipments have been made

Utah Copper Company—The first of the three sections dismantled at the Arthur mill will be recommissioned about March 1. This mill comprises 13 sections, which will be taken down in lots of three, and chilean mills substituted for the Nissen stamps.

Summit County

Silver King Consolidated—Ore was opened in a new place west of the discoveries of Feb. 20.

Daly West—It is reported that the treasury is in a condition to justify the regular quarterly dividend in March.

New York Bonanza—The ore on the 900-ft. level has been followed about 200 ft., but no attempt has been made to open it on the 1000-ft. level, as pumping would be necessary.

Ontario—It is reported that a long-time lease has been obtained on this property by Salt Lake people. A considerable tonnage of milling ore has been estimated as available.

Washington

Germania—Machinery is being hauled to this tungsten mine, at Deer Trail. The product is shipped direct to the Krupp works, Essen, Germany.

White Elephant—Operations will be extended this spring; Frank Ashley, Orient, superintendent.

Republic Mines Company—This company has paid the $225,000 bond and declared $85,000 dividends last year; J. L. Harper, Republic, in charge.

United Copper—Two cars of ore per week are being shipped to the smeltery; Conrad Wolfe, Chewelah, in charge.

Wisconsin

The electric power plant at Galena will be enlarged and the pole lines extended.

Frontier—A 3 per cent. monthly dividend has been declared. Last year the rate was 2 per cent.

Board of Trade—This Cuba City mine declared a 5 per cent. monthly dividend.

Etna—This mine at Benton is being developed by Superintendent George W. Alderson.

Mills—This Hazel Green mine has opened an orebody beneath the "oil rock."

Murphy—This mine at Hazel Green is being prospected for lead.

Cleveland—Foundations for mill and power plant are being laid.

Coon Branch—The mine has been sold to the New Jersey Zinc Company.

Winskill—The mine at Shullsburg is producing one car of concentrate per day.

Wyoming

Systematic development is being carried on in Wyoming oilfields. Oil has been found in nearly all the counties of the State; it is said that there are already 116 producing wells in the central Wyoming fields. At Cheyenne a $10,000,000 company has been incorporated, called the Wyopo Pipe Line Company, which is to construct pipe lines and storage tanks. Pipe lines will be constructed, it is said, to the Burlington and the Chicago & Northwestern railroads, giving an outlet northwest, east and south, and another line through Cheyenne to Denver. The storage tanks will have a capacity of more than 1,000,000 barrels.

Canada

BRITISH COLUMBIA

Boundary Mining and Exploration Company—A tipple and hoist will be installed at the coal mine at Midway.

Granby—Eight furnaces are in blast and the largest output of copper in the history of the company is now being made.

ONTARIO—COBALT

The shipments from Cobalt for the week ended Feb. 17 were: La Rose, 226,090; Nipissing, 186,890; Beaver, 63,600; Buffalo, 60,110; Hudson Bay, 61,100; O'Brien, 60,060; Kerr Lake, 60,040; Cobalt Lake, 60,000; McKinley-Darragh, 59,800; Crown Reserve, 56,800; King Edward, 40,000; total, 934,490 pounds.

Temiskaming—The report for the year ended Jan. 31, 1911, shows receipts from sale of ore, $1,017,688; from other sources, $5000. Expenditures were $308,071, leaving a profit of $714,319, about 35 per cent. of the company's capital stock. There were produced 1029 tons of ore averaging 1819 oz. silver. The ore reserve is stated to be 118,681 tons, containing 4,805,532 oz. of silver.

Gould Consolidated—Connection with the power system has been secured.

Rochester—The capital stock is to be increased from $1,500,000 to $2,500,000. Old shareholders may secure 600,000 of the new shares for not less than 5c. per share.

Standard—Diamond drilling will be started on the main vein.

British Canadian Power Company—This company which supplies compressed air and electric power to a large number of mines, is making extensive additions to its plant, and will shortly have 750 h.p. more, available. At present it is supplying 3500 horsepower.

Cobalt Hydraulic Company—This company, which operates the largest natural air compressor in the world, is having trouble on account of a shortage of water.

Beaver—The powder house exploded, killing one man, besides doing considerable damage.

Nova Scotia—A rich ore-shoot has been encountered on the 80-ft. level.

Bailey—The annual report of the company shows a surplus of $26,529 besides a car of concentrates on hand.

ONTARIO—PORCUPINE

Hollinger—The greater part of the machinery for the 30-stamp mill is on the ground and the company hopes to have it running by next July. The estimated capacity is 150 tons per day.

Preston East Dome—A compressor plant has been ordered. The Tisdale and Armstrong Booth properties will also install plants.

Mexico

The National Railways of Mexico have let contracts for the long-projected railroad that will open the Sombrerete, Nieves and Chalchihuites mining districts of this state. It will extend from Cañitas, a station on the Mexican Central, now one of the merger roads, to the city of Durango, capital of the state of that name. A total of 296 km. of track will be laid. The town of Sombrerete will be reached over a branch line 11 km. long, its mountainous situation making this necessary. The Compañia Bancaria de Obras y Bienes Raices, which has the contract for 170 km. out of Durango, has already started work, and the International Contracting Company, which will build from Cañitas to Sombrerete, 126 km., will soon commence construction. The line will also open the Nombre de Dios and other mining districts of Durango. The Zacatecas government has agreed to a subsidy of 680,000 pesos for the Zacatecas portion of the line, and the Durango government will contribute 600,000 pesos for the Durango section. The Robert S. Towne interests, which have extensive holdings in the Zacatecas districts that will be benefited, will also contribute toward defraying the cost of construction. The line will cost several million pesos. The concessions for the railroad were formerly held by the Towne interests, and a company was formed to build it. The financial depression in the United States a few years ago interfered with the plans, and some time ago the concessions were taken over by the government merger system.

BAJA CALIFORNIA

Compañia Metalurgica de Baja California—A 50-ton cyanide filtration plant will be built at La Paz.

CHIHUAHUA

Rio Plata—The cyanide plant treated in January 2309 tons of tailings, containing 83,282 oz. of silver, of which 71,289 oz. were recovered. Expenses were $11,659; operating profit, $23,520.

Los Angeles—A 30-ton cyanide plant will be built. Stallforth & Hermano, Parral, owners.

Galena—Extensive alterations are being made and new machinery will be installed at this Parral mine.

San Julian—An 80-ton mill is being built.

San Toy—The payment of the initial dividend of 1 per cent. is announced.

GUANAJUATO

Oro Grande—Regrinding equipment has increased the capacity of the Guanajuato Amalgamated plant to 500 tons daily.

Tula—The new 20-stamp concentrating and cyaniding plant is in commission.

Providencia—Of the 40 stamps, 20 are in commission, and the remainder will be dropping within a short time.

Nayal—This mine, owned by the Dwight Furness Company, has been leased by the Mexican Milling and Transportation Company, which is operating the Nayal custom mill.

Mineral Development—The Proprietary Mines Company of America is financing both the Providencia and Mineral Development.

San Matias—The Mexican Milling and Transportation Company, is building an aërial tramway to dumps and opencuts beyond the Sirena mine, a distance of about 2 kilometers.

Guanajuato Consolidated—Due to a scarcity of profitable ore, only 40 of the 80 stamps are dropping.

JALISCO

Carrizo Copper—During the last few weeks the smeltery has been reducing 60 tons of ore per day, producing 8 tons of 45 per cent. copper matte.

MEXICO

Esperanza—Ore reserves Dec. 31 were estimated at 367,363 metric tons, containing $1,408,618 in gold and silver; estimated profits to be derived from treating tailing dumps, $603,861.

SINALOA

Mazatlan Copper and Gold Mining Company—Gold ore has been struck on this property near Tecoripa river.

SONORA

San Rosalia—Reorganization to provide development funds is planned.

Transvaal—Contracts for 5000 ft. of drilling have been let.

TAMAULIPAS

It is rumored that the American Smelting and Refining Company is to erect a zinc smeltery at Nuevo Laredo.

ZACATECAS

San Roberto—A concentrator is to be built at this Zacatecas mine.

South America

BRAZIL

President Fonseca has signed a decree granting two Brazilian capitalists a 25-year concession for a 150,000-ton steel plant in the State of Minas Geraes, with a subvention of $3 per ton on ingots, $8 per ton on rails, plates and structural material and $10 per ton on certain other material. The Government is pledged to take 50,000 tons annually, and it is restricted from buying foreign-made material unless the inspectors prove that the material made at the new plant is inferior. The holders of the concession are exempted from duty on coal and coke and will receive preferential rates on the Government railroads.

The Markets

Coal Trade Review

New York, March 1—The coal trade in the East, both bituminous and anthracite, continues quiet and without special features.

In the West the conditions of oversupply and low prices are still prevalent. Some improvement in the demand for steam coal is reported, but it has not yet helped business to any great extent.

The attempt of the Indiana and Illinois operators to get together in some way to restrict production and stop the present sacrifice of coal is being worked out. This plan, with the help of some local papers, is being expanded into a scheme for a grand Western combine, as noted on another page. There is little probability that it will be carried out, at any rate, on the scale proposed.

Comparative Coal Rates—A statement compiled by the Coal Committee of the Pittsburg Chamber of Commerce gives the rates per ton-mile on coal to Cleveland for Lake shipment as follows: From Pittsburg district, 0.652c.; Eastern Ohio, 0.639c.; Fairmont, W. Va., 0.410c.; Kanawha, 0.306c.; New River, 0.281 to 0.306c. The rate from the Pittsburg district to Chicago is 0.406c.; from the Pocahontas district, W. Va., 0.320c. per ton-mile.

Coal Traffic Notes

Coal tonnage of Norfolk & Western railway, seven months of fiscal year, July 1—Jan. 31, short tons:

District.	Commercial.	Company.	Total.
Pocahontas	6,423,645	635,263	7,058,908
Tug River	998,001	277,468	1,275,469
Thacker	932,998	366,785	1,299 783
Kenova	444,401	93,161	537,562
Clinch Valley	497,550	34,762	532,312
Total	9,296,595	1,407,439	10,704,034

As compared with the corresponding months of 1909-10, there was an increase of 1,482,327 tons, or 16.1 per cent.

Coal receipts at Boston in month of January, reported by Chamber of Commerce, in long tons:

	1910.	1911.	Changes.
Anthracite	136,978	142,675	I. 5,697
Bituminous	269,401	324,553	I. 55,152
Total domestic	406,379	467,228	I. 60,849
Foreign	24,839	26,220	I. 1,381
Total	431,218	493,448	I. 62,230

The foreign coal reported is nearly all from Nova Scotia mines.

New York

Anthracite

March 1—Alternate spells of warm and cold weather seem to have balanced each other, so far as effect on the domestic trade is concerned. The collieries have been restricting output a little; while dealers are holding back, hoping to have their stocks cleaned out before the April discount comes on.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Schedule prices for domestic sizes are $4.75 for lump, $5 for egg and stove and $5.25 for chestnut, all f.o.b. New York harbor. For steam sizes current quotations show a little more variation, and may be given at $3@3.25 for pea; $2.25 @2.75 for buckwheat; $1.75@2.20 for buckwheat No. 2 or rice; $1.35@1.65 for barley; all according to quality, f.o.b. New York harbor. The lower figures are usually for individual and washery coals.

Bituminous

The seaboard soft-coal trade does not yet begin to show the anticipated improvement, though general business is improving. Both harbor and coastwise buying is slow, and there is a disposition to dicker and shop around for cheap coal.

Prices are nominally about the same. Gas coals bring $1@1.10 at mine for ¼-in., 95c.@$1 for run-of-mine, and 70c. for slack. Fair steam coals can be had for $2.60, f.o.b. New York harbor, lower grades down to $2.35@2.45, with better coals up to $2.80@2.90. There seems to be a surplus of coal at tide, and offers of such coal at low prices to avoid charges hold the market down. The New River people have been keeping down production and shipments, and low-priced West Virginia coals are less in evidence. Car supply and transportation are good.

There is some talk about yearly contracts, but little has been done yet, except in a few high-grade coals which have a special market.

In the coastwise trade larger vessels are plenty, but small boats are rather scarce. Tonnage can be had on a basis of 70@80c. from Philadelphia to Boston; 55@65c. from New York to points around the Cape. Rates are generally firm.

Birmingham

Feb. 27—The coal trade is still active though not quite as active as it was last year. The shipments of coal from this district to New Orleans are still steady and in good quantity. Contracts are under consideration for coal to go to other Southern ports.

Development is going on in various parts of the district and during the coming summer it is figured there will be at least three or four large mines opened for operation.

The chief State mine inspector reports that figures on the output during 1910 are in hand already to show a total production of nearly 16,000,000 tons in Alabama.

The coke production is fairly steady with a good demand.

Chicago

Feb. 28—A spurt of cold weather brought about a little better business, but it has only lasted a few days, and the effects will soon pass. Steam coal is about the same, with demand for screenings much better than for lump. The shipments to this market are still too large.

Illinois and Indiana coals bring $2@2.40 for lump, $1.60@1.80 for run-of-mine and $1.50@1.80 for screenings. Smokeless holds at about the same price as last week, receipts being moderate, and Hocking is $3@3.15. There is very little doing in anthracite.

The talk about a big combination of mines in the West is making quite a stir, but the plan is not considered practicable, for many reasons.

Cleveland

Feb. 27—Trade is improving, as the demand for steam coal is growing better. Domestic trade has been started up a little by cold weather, but this is probably only a temporary spurt. At any rate, more coal is moving, and stocks have been reduced. Prices are unchanged, but are more firmly held.

Indianapolis

Feb. 27—As a result of a conference between the Indiana and the Illinois coal operators, a committee has been appointed to consider methods by which a more stable market may be maintained for the sale of coal in the cities, especially Chicago, which takes over 50 per cent. of the output of the Indiana and Illinois mines. This committee is composed of seven Indiana and 18 Illinois operators. The discussion at the conference touched on every possible means of remedying the conditions that have recently demoralized the market. It was agreed that a pool agreement or a sales-agency scheme would likely bring prosecutions under the law and an effort will

be made to get the laws amended. Some years ago eight or 10 Indiana operators were prosecuted for adopting a sales-agency scheme, and they are now wary about any pooling arrangement.

Operators say they are tired of being held up by the middlemen, who do not produce or consume coal. How to get rid of the middlemen was a difficult proposition. Within the last few years these so called coal dealers have become numerous; many of them have become purchasing agents for large consumers, and have given the operators to understand that they must be taken into account in any deal for the sale of coal. These middlemen have no yards, nor any arrangement to handle coal, but collect their commission on the sales, the operator shipping the coal direct to the consumer. The operators figure that, between the miner and the consumers, there are a number of useless costs, not to speak of the loss in transit.

Pittsburg

Feb. 28—The railroads under date of Feb. 27 have issued a new tariff, effective March 29, on coal from Group 1, the Pittsburg district, and Group 2, practically the Connellsville district, to Lake Erie ports. This replaces a tariff recently filed, and disapproved by the Interstate Commerce Commission. It leaves the rates unchanged on coal for vessel cargoes, at 88c. and $1 respectively, and also the rates on commercial coal, for consumption at ports, $1 and $1.15, but it transfers from the first category to the second coal used for Lake vessel fuel, thus making an increase of 12c. in the rate on coal used by the vessels.

On Feb. 25, the Interstate Commerce Commission suspended the increases scheduled for Mar. 15, until Sept. 15, in rates from West Virginia and Kentucky fields to the lake, so that for the coming season rates on coal for the Lake trade will be the same as formerly. Under pressure from the Ohio operators the railroads had been induced to advance their rates from the more distant fields. Since the advances were determined upon, however, the agitation was started for a lower rate from the Pittsburg district, on the plea that there was strong discrimination in favor of the West Virginia and Kentucky fields, having regard to rates per ton-mile, and this put the railroads on the defensive, so that there is reason to suspect that had the Interstate Commerce Commission not suspended these increases the railroads would have withdrawn them, in order to have a free hand to combat the agitation for a modification of the differentials between Pittsburg and the more distant fields.

The local coal market continues sluggish, with mines running part time and prices unsatisfactory. We quote as approximately the market: Mine-run and nut, $1; ¾-in., $1.10; 1¼-in., $1.20; slack, 82½@85c. per ton at mines.

Some coal is expected to go down the river on the present rise, but shippers are hampered by the fact that most of the steamboats are down the river. There is nearly 5,000,000 bu. of coal in the harbor.

Connellsville Coke—The Republic Iron and Steel Company has bought 10,000 tons of furnace coke for March at $1.60, ovens, and 10,000 tons a month March to December, inclusive, at between $1.70 and $1.75. This practically covers the company on the coke it requires from the outside, its own production supplying the major part of its consumption, while it bought some coke for this year last December. The coke market has continued to gain in strength, with prices for both prompt and forward already higher, and only a little coke available at present prices for the balance of this half year. There is plenty more coke capacity, but those who control it would hold out for considerably higher than ruling prices. We quote the market as follows: Prompt furnace, $1.55@1.60; contracts to July 1, $1.60@1.65; second-half contracts, $1.80@2; prompt foundry, $2@2.10; contract, $2.25@2.50 at ovens.

The *Courier* reports the production in the Connellsville and lower Connellsville region in the week ended Feb. 18 at 322,765 tons, a decrease of 600 tons, and shipments at 3835 cars to Pittsburg, 5568 cars to points West and 699 cars to points East, a total of 10,102 cars.

St. Louis

Feb. 27—The market for the past week has shown a slight improvement in tonnage, owing to the cold weather. Of course, a spasmodic flurry of this kind does very little to improve the demand for coal. Wholesalers did not feel the slightest impetus, though retailers report the little spurt helped them to reduce their supply on hand.

The demand for steam coals, especially screenings, has been very good. Never in recent years have the prices of screenings, mine-run and lump been so nearly the same as they are at present. In the Standard group, mine-run and screenings are selling for identically the same. Standard lump is only bringing about 5c. per ton more while steam nut, which is very scarce, is bringing more than any other size, bringing about 15c. per ton more than mine-run and 10c. per ton more than lump. This situation has been brought about by the large increase in number of automatic stokers and by light demand on domestic lump. The day when all the profit was made out of the lump by selling it to dealers and the screening were practically given away to steam plants is a thing of the past; in fact, if the present tendency continues it looks very much as if the shoe would be on the other foot.

Anthracite—Owing to the fact that the weather has been so warm, all jobbers of anthracite have stopped their shipments; it is now too late to order any coal from the mines on the old circular and there is very little coal in transit. The supply of anthracite is light and grate size is very short.

FOREIGN·COAL·TRADE

Belgian Coal Trade—Imports and exports of fuel in Belgium, year ended Dec. 31, metric tons:

	Imports.	Exports.	Excess.	
Coal.....	6,444,437	4,961,346	Imp.	1,483,091
Coke.....	499,575	1,043,434	Exp.	543,859
Briquets.....	277,275	545,545	Exp.	268,270
Total.....	7,221,287	6,550,325	Imp.	670,962
Total, 1909....	6,337,770	6,651,090	Exp.	313,320

The principal trade, both imports and exports, is with Germany and France.

French Coal Production—Output of the Nord and Pas-du-Calais districts in France, year ended Dec. 31, metric tons:

	1909.	1910.	Changes.	
Nord	7,219,452	7,353,933	I.	134,481
Pas-du-Calais....	19,298,791	19,840,143	I.	541,352
Total coal.....	26,518,243	27,194,076	I.	675,833
Coke made.....	1,947,237	2,109,692	I.	162,655
Briquets made...	1,505,803	1,630,193	I.	124,390

These two districts produce about 80 per cent. of the coal mined in France.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of coal on Feb. 18, as follows: Best Welsh steam coal, $4.26; seconds, $4.08; thirds, $3.90; dry coal, $3.96; best Monmouthshire, $3.84; seconds, $3.66; best small steam coal, $2.34; seconds, $2.10. All prices are per long ton, f.o.b. shipping port, cash in 30 days less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, March 1—The decision in the railroad-rate cases, which has been held out as a probable turning point in the iron markets, has at last been rendered and it is adverse to the companies. As with many other anticipated events, it does not appear to have had more than a sentimental effect. There has been no cancelation of orders and no special change in the volume of new business. As a matter of fact, it looks as if the railroads would go on buying needed equipment and material for repairs about as they have been doing for some time past. At the same time it must be remembered that railroad consumption of iron and steel, while large and important, is no longer the controlling factor in the trade which it once was—and which Wall Street seems to think it still is. The building industries, into which iron and steel now enter so largely, have taken the first place for some time past.

Generally speaking, trade has been fair, though new orders have been a little below the level of the first part of

February. There is a continued run of new business, however, and in some branches mills are drawing up nearer to their capacity than they have been for some time past. Export trade is reported active in several branches. It is stated that foreign orders have recently been placed for 60,000 tons of rails, besides other material.

Buying of foundry pig iron has been rather quiet in Eastern territory. Second-half business is still held up by differences over price, though there have been a number of inquiries. Southern makers are pushing for business for second quarter, but are not keen about taking second-half contracts just yet. For basic pig a good demand is reported in the Central West.

In finished material there continues to be a good demand for bars, sheets, wire and tinplates. Quite a number of small structural orders are coming, and some larger ones are under negotiation as spring approaches. The Chicago & Northwestern company has placed orders for 40,000 tons of rails, and smaller orders amount to 20,000 tons more for the week. The spring jobbing trade in the smaller building materials is reported to be opening up well.

Iron Ore Imports—The Cleveland *Iron Trade Review* reports that arrangements have been completed for bringing to this country about 250,000 tons of Spanish ore, practically all representing new sales just closed.

Baltimore

Feb. 28—Imports for the week included 910 tons manganese ore from Antwerp; 54 casks manganese ore from Hamburg; 18,700 tons iron ore from Cuba.

Birmingham

Feb. 27—While more pig iron was sold during the month of February than in January the quotations have been weak; $11 per ton, No. 2 foundry, being the top price for iron in the South, so far as delivery during the first half of the year is concerned and where special analysis iron is not required. Some sales are said to have been made under $11. The buying in the Southern territory was by consumers in various parts of the country, mostly cast-iron pipe makers. There are still inquiries for iron in hand and one or two companies are said now to be out of the market so far as iron for delivery during the first half of the year is concerned.

The steel situation shows improvement again. At both the Ensley plant of the Tennessee company, and the Gadsden plant of the Southern company, additional open-hearth furnaces have been put on recently. There is a steady demand for rods, wire and nails as well as for fabricated steel.

Chicago

Feb. 28—The decision against the railroads in the rate cases seems to have affected the market only for a day or two. The buying of pig iron continues to increase. Inquiries for second-half iron still come in, but there is the same trouble about prices, and business has been limited to second-quarter deliveries for the most part. Nominal quotations are still $16 for Northern No. 2 and $11 Birmingham—$15.35 Chicago—for Southern. There are some sales above and below these points. For second-half at least 50c. more is asked, but not yet conceded. The tendency is upward, however.

Sales of iron and steel products are moderate, but the tendency is to increase. Coke is weak at $4.70 for Connellsville.

Cleveland

Feb. 27—The Pittsburg Steamship Company has bought the three new boats lately built for the Western Transportation Company. These vessels cost about $600,000 each; they are 606 ft. long and can carry 13,500 tons of coal or 12,000 tons of iron ore. The three will add about 750,000 tons of ore in a season to the carrying capacity of the Steel Corporation fleet.

Pig Iron—Interest centers in inquiries for second-half deliveries. Buyers and sellers are still far apart on these; furnaces are reluctant to quote on them. Current and second-quarter business is fair. Prices for Cleveland delivery are $15.90 for bessemer, $14.40 for basic, $14.25 for No. 2 foundry, and $17.50 for Lake Superior charcoal.

Finished Material—Quite a business has been done in bars, small structural orders, and small material, such as spikes, bolts and nails.

Philadelphia

March 1—An interesting feature of the pig-iron market this week is the receipt of some inquiries and a few actual orders, which have been accepted for the delivery of foundry grades of pig iron for the third quarter of the year. As a result of vigorous efforts of a few Southern makers considerable Southern iron has been sold in this and farther Eastern territory for delivery up to the end of June. These large sales have hardened Southern quotations and have reflexly favored Pennsylvania irons. Elements of weakness have disappeared within a few days, though but few large transactions have been closed. Western advices, which show large sales, have also strengthened the tone of the market in the East. Unusual activity has developed in pipe iron and the latest quotations show a nominal advance of $25. Forge irons remain where they were; demand is dull and but few inquiries are received. Basic iron is doing better in small lots. While no changes have been made in quotations, it is doubtful even now whether makers would accept large orders at prices made within two weeks.

Billets—The movement in billets during the week has been the first sign of a general improvement. The demand for open-hearth is indicated in a number of inquiries from large consumers. Nearly all users of forging billets have sounded the market within a few days.

Bars—Nothing is likely to happen to improve bar-iron quotations, because of the large idle capacity and the long options which several mill owners have extended to large consumers.

Sheets—The sheet mills are unable to show much improvement in local demand, but expect to close some good-sized orders in New England. Building demands are under consideration for corrugated.

Pipes and Tubes—Cast pipe is quite active. Merchant pipe continues dull and stocks are ample for current distribution.

Plates—Shipbuilding inquiries and orders have helped to improve the market and an increase in small local orders for construction purposes is noted. Buying is restricted to early deliveries.

Structural Material—Construction requirements in some of the large Eastern cities are the events of the week. Local transactions will be closed within a few days for something like 3000 tons. The outlook for structural is better than for some months. Manufacturers assert the lowest shadings made a few weeks ago are now withdrawn.

Scrap—The improvement in the scrap market continues and the cheaper grades are now sharing in it. Heavy melting steel continues to move as fast as it can be had. Railroad scrap is being held a little higher by owners, but it is wanted and it will bring the price asked for.

Pittsburg

Feb. 28—The sweeping decision of the Interstate Commerce Commission against the railroads in the "advanced rate cases," handed down Feb. 23, has given the iron and steel market a chill, inasmuch as a compromise was expected, giving the railroads a portion, perhaps half, of the advances they asked for. Being disappointed in its expectations, the iron trade can see no good in the decision, and the current talk is of further curtailment in purchases by the railroads. This attitude is the creation of the railroads by their 10 months' campaign of publicity in favor of the advances, and dispassionate analysis of the situation will in all probability lead the trade ultimately to take a more cheerful view of the situation.

Total bookings of finished steel prolucts by steel companies in February will slightly exceed those for January. The

average rate in February has been slightly less than in the closing days of January, but bookings were very light in the fore part of January. Production has been at a much greater rate, and the gain in unfilled orders of the Steel Corporation in February will on this account undoubtedly prove to be much less than that of 436,162 tons shown for January. Most of the prominent independent steel companies are running at from 70 to 85 per cent. of their capacity, while the Steel Corporation is operating at about 65 per cent. of its finishing capacity.

Prices of finished steel products are stationary. There is no shading of consequence, but since the freight rate decision nothing is heard of the previously rumored advances in wire products and pipe.

Pig Iron—The movement in basic pig iron appears to be about over. Including sales reported in the past two reports, there has been a total of about 35,000 tons moved, including one block of 5000 tons sold to an Ohio river consumer and another block of 10,000 tons to an Allegheny river consumer, both by a steel works interest on the Ohio which does not sell regularly. Practically all the remainder of the basic iron sold was by middlemen. The movement started by the merchant furnaces marking up their prices to a minimum of $14, Valley, giving the market to the outsiders, who sold at constantly advancing prices up to $13.75, Valley. The market is now quotable at $13.75, Valley, on the basis of the last sale, and at $14, Valley, on the basis of the minimum asking price of furnaces. There is still iron in the hands of middlemen, who will name a close price only on a likely looking inquiry, and as the consumers are well covered for the immediate future the market is not promising much activity for a few weeks. A sale of 1000 tons of bessemer has been made at $15, Valley, the regular price. Foundry iron continues the strength reported last week, and is quotable at $14, furnace. A sale of 3000 tons of malleable is reported, and another sale of 200 tons, the latter at $13.75, Valley.

Ferromanganese—The market is very quiet, and continues quotable at $37.50 for prompt and $38 for forward delivery, f.o.b. Baltimore, freight to Pittsburg being $1.95 per ton.

Steel—Deliveries of billets and sheet bars are good on contracts, and prices are firm, with several producers out of the market entirely at the regular market figures, which remain at $23 for billets and $24 for sheet bars, Pittsburg or Youngstown. Rods are $29, Pittsburg.

Sheets—There has been a slight gain in activity in the sheet market, and mill operations average between 60 and 65 per cent. of the total capacity. Prices are well held at 2.20c. for black, 3.20c. for galvanized, 1.65c. for blue annealed, 10 gage, $1.55 for painted corrugated and $2.75 for galvanized corrugated.

St. Louis

Feb. 27—The pig-iron market shows a fair volume of business. There have been some good inquiries for Northern iron, though Southern iron, which forms the bulk of the trade, is dragging. The price of $11 per ton, f.o.b. Birmingham or $14.75 per ton, f.o.b. St. Louis, still prevails.

FOREIGN IRON TRADE

Canadian Pig Iron—Pig iron production in Canada for the full year is reported by the American Iron and Steel Association as below, in long tons:

	1909.	1910.	Changes.	
Foundry and forge..	149,580	153,626	I.	4,04
Bessemer.....	169,545	221,494	I.	51,949
Basic.....	357,965	365,090	I.	7,125
Total.....	677,090	740,210	I.	63,120

The production in 1910 was the largest on record. There were in Canada at the close of 1910 a total of 17 furnaces, 13 using coke and 4 charcoal. Two new coke furnaces were under construction.

In 1910 the Canadian furnaces consumed 1,355,057 tons of iron ore and 98,853 tons of mill cinder, scale, etc., in the manufacture of pig iron. They also consumed 510,650 tons of limestone for fluxing purposes. Of the total production in 1910, there were 724,174 tons made with coke and 16,036 with charcoal.

METAL MARKETS

New York, March 1—The metal markets generally have been inclined to quiet, and few changes are reported. The speculation in tin continues.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Jan. 1911..	$ 921,360	$ 9,540,830	Imp.$ 8,619,470
" 1910..	6,163,132	2,131,357	Exp. 4,031,775
Year 1911..	921 360	9,540,830	Imp. 8,619,470
" 1910..	6,163,132	2,131,357	Exp. 2,131,357
Silver:			
Jan. 1911..	5,651,076	3,551,426	Exp. 2,099,650
" 1910..	4,498,304	4,248,354	" 249,980
Year 1911..	5,651,076	3,551,426	" 2,099,650
" 1910..	4,498,304	4,248,354	" 249,980

Exports from the port of New York, week ended Feb. 25: Gold, $46,900; silver, $1,071,380. Imports: Gold, $162,282; silver, $127,662, from Central and South America, Australia and Japan.

Gold—The price of gold on the open market in London remained at the normal level, 77s. 9d. per oz. for standard bars and 77s. 4½d. per oz. for American coin. Supplies arriving were divided between the Bank of England and the Indian government. There was no special demand.

Platinum—Business is reported good and there has been an advance in prices. Dealers are now asking $41 per oz. for refined platinum; $43.50@44 for hard metal, 10 per cent. iridium.

Silver—The market has been fairly steady, fluctuating between narrow limits. London brokers keep bearish on the market, but in spite of their views the price is quite well maintained.

SILVER AND STERLING EXCHANGE

Feb.-Mar.	23	24	25	27	28	1
New York....	52½	52⅞	53	52¾	52⅝	52¾
London.....	24 3/16	24 3/16	24 7/16	24 3/16	24 1/16	24 3/16
Sterling Ex..	4.8630	4.8640	4.8655	4.8650	4.8645	4.8630

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

The price of silver in London on Feb. 22 was 24 1/16d. That day was a holiday in New York, but not in London.

Shipments of silver from London to the East, Jan. 1 to Feb. 16, as reported by Messrs, Pixley & Abell:

	1910.	1911.	Changes.	
India.....	£1,153,900	£1,395,300	I.	£241,400
China.....	257,000	406,000	D.	149,000
Total.....	£1,410,900	£1,801,300	I.	£390,400

India Council bills in London brought an average of 16.11d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

Feb.-Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. New York, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
23	12½ @12⅝	12.20 @12.30	42⅛	4.37½ 4.42½	4.22½ @4.25	5.60 @5.62½	5.45 @5 47½
24	12½ @12⅝	12.20 @12.25	41⅛	4.37½ 4.42½	4.22½ @4.25	5.60 @5.62½	5.45 @5.47½
25	12⅝ @12⅝	12.20 @12.25	41⅛	4.37½ 4.42½	4.22½ @4.25	5.60 @5.65	5.45 @5.50
27	12½ @12⅝	12.20 @12.25	42⅛	4.37½ 4.42½	4.22½ @4.25	5.62½ @5.65	5.47½ @5.50
28	12½ @12⅝	12.20 @12.25	42⅛	4.37½ 4.42½	4.22½ @4.25	5 62½ @5.67½	5.47½ @5.52½
1	12½ @12⅝	12.20 @12.25	41⅜	4.37½ 4.42½	4.22½ @4.25	5.62½ @5.67½	5.47½ @5.52½

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The market is quiet and somewhat easier. Manufacturers both in this country and in Europe report a fair volume of new orders from day to day, but as they are well supplied with copper they have not been in the market. Inquiry during the past week has been small, and the few orders that presented themselves were eagerly competed for. Domestic business has been done at

LONDON

Feb.Mar.	Copper.			Tin.		Lead,	Zinc,
	Spot.	3 Mos	Best Sel'td	Spot.	3 Mos	Spanish.	Ordinaries.
23	55	55 11/16	59	193	188 3/4	13 3/16	23 1/8
24	54 7/8	55 1/8	58 3/4	192	187 1/2	13 3/16	22 7/8
25	.....	.....	.....	.....	.....	.....	.....
27	54 13/16	55 1/4	58 3/4	191 1/2	186 1/2	13 1/4	22 7/8
28	54 3/4	55 1/16	58 3/4	193	186 1/2	13 1/4	22 7/8
1	54 11/16	55 3/8	58 3/4	189	184	13 1/4	23

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

12⅜c., delivered at buyers' works, usual terms. Offers of 12¼c., cash, New York, have been rejected, but 12.20c. has been bid. Lake copper closes at 12½@12⅝c., and electrolytic copper in cakes, wirebars and ingots at 12.20@12.25c. Casting copper is quoted nominally at 11⅞@12⅛ cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 13½c. base, carload lots at mill.

The London market for standard copper has been stagnant and fluctuated within narrow limits. It closes at £54 13s. 9d. for spot, and £55 7s. 6d. for three months.

Copper exports from New York for the week were 7025 long tons. Our special correspondent gives the exports from Baltimore for the week at 1347 tons.

Tin—Transactions on the London Metal Exchange show a further shrinkage. There is also an increased backwardation for three-months tin, which now amounts to about £5, as against not more than £1 during the recent heavy trading. These facts are not very inspiring as far as the future of the market is concerned, and it seems as if the syndicate had liquidated a large part of their holdings. In this market, where spot tin is still very scarce and held at a heavy premium, very little buying was done by consumers. The few large orders that presented themselves were eagerly competed for, and some price cutting was indulged in. The market closes weak, quotations in London being £189 for spot, and £184 for three months, and in New York 41⅜c. for March and 41c. for April shipment.

Lead—The market is quiet and somewhat easier. Most of the transactions were for Missouri lead, which is quoted at 4.22½@4.25c. at St. Louis, and 4.37½@4.42½c. at New York.

The London market for lead is firmer, and Spanish lead closes at £13 6s. 3d.; English lead at £13 8s. 9d. per ton.

Spelter—The galvanizing business continues to improve, and there has been a good demand for spelter from day to day. The transactions of the last week have run to a large tonnage. Buyers are poorly covered and as stocks in the hands of smelters are not large, the market appears to be sensitive, with an upward tendency. Prices advanced somewhat during the last week, and on Feb. 28 and March 1 round lots were sold at 5.50c. At the close we quote St. Louis at 5.47½@5.52½c., and New York at 5.62½@5.67½ cents.

The London market for spelter is somewhat easier, good ordinaries being quoted at £23, and specials at £23 5s. per ton.

Base price of zinc sheets is $7.50 per 100 lb., f.o.b. La Salle-Peru, Ind., less 8 per cent. discount.

By typographical error the price of spelter at St. Louis was given at 5.22½@5.37½ for Feb. 3 and 4. The correct figure is 5.22½@5.27½ for both days.

During 1910, Germany imported 134,391 metric tons of zinc ore from Australia, 8436 from the United States and 2192 from Mexico.

We have previously referred to the large exportation of sheet zinc from Europe to Argentina in 1910. It appears now that Germany alone sent out 4507 metric tons, compared to only seven tons in 1909.

The German zinc-selling union is now allowing a graduated scale of discounts on large transactions.

Other Metals

Aluminum—The market has again been rather quiet, with moderate sales. We continue to quote 21@21½c. per lb. for No. 1 ingots in large lots, New York.

Antimony—It is understood that the foreign antimony convention has been finally organized, the concerns interested covering all the sources of supply. The convention will control production and prices. We understand that Beer, Sondheimer & Co., and Altheimer, Speier & Co.—both of Frankfurt and New York—are to be the joint selling agents of the syndicate.

In consequence of this action there has been a sharp advance in the metal. The actual volume of business has not been great, but buyers are anxious and are pressing for some concessions on prices, which dealers are not prepared to make, as they are themselves uncertain. The new quotation is 8¾c. per lb. for all brands.

Quicksilver—The situation is peculiar. The market is bare of supplies, and present demand cannot be satisfied. In New York a quotation of $52 per flask is given, but it is entirely nominal, as none is offered for sale. San Francisco price is $51 for domestic and $2 less for export. The London price has again been advanced £1, and is now £10 per flask, with jobbers quoting the same figure.

Bismuth—The current price of bismuth in London is 7s. 6d.—or $1.80—per lb. This price has been maintained for several months.

Cadmium—Current quotations are 60@70c. per lb. in 100-lb. lots, f.o.b. New York, according to quantity of metal. The price in Germany has recently advanced and is now 575@600 marks per 100 kg.; equal to 63.4c. per lb., average.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot, from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Spanish Metal Exports

Exports of metals and minerals from Spain, 12 months ended Dec. 31, reported by *Revista Minera*, in metric tons:

Metals.	1909.	1910.	Changes.	
Pig and manuf. iron	63,182	38,532	D.	24,650
Copper	17,893	18,110	I.	217
Copper precipitate	16,843	13,983	D.	2,860
Lead	183,640	191,027	I.	7,387
Zinc	1,606	2,263	I.	657
Quicksilver	1,503	1,311	D.	192
Minerals.				
Iron ore	8,179,877	8,246,038	I.	66,211
Manganese ore	14,737	6,321	D.	8,416
Copper ore	1,083,991	939,419	D.	164,572
Lead ore	3,653	3,456	D.	197
Zinc ore	130,718	123,531	D.	7,187
Pyrites, iron	1,360,329	1,504,778	I.	144,449
Salt	558,721	504,218	D.	54,503

Imports of phosphate of lime, 82,697 tons in 1909, and 109,106 in 1910; superphosphates and basic slag, 177,431 tons in 1909, and 237,227 in 1910; nitrate of soda, 33,082 tons in 1909, and 32,741 last year.

Zinc and Lead Ore Markets

Platteville, Wis., Feb. 25—The highest price paid this week for zinc ore was $42 per ton; the base price 60 per cent. zinc, was $41.50 per ton.

The base price paid for 80 per cent. lead ore was $53 to $53.50 per ton.

SHIPMENTS, WEEK ENDED FEB. 25.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	814,200	.....	.....
Platteville	795,200	.....	392,000
Galena	410,800	.....	.....
Benton	249,000	.....	.....
Hazel Green	160,000	.....	.....
Shullsburg	84,600	.....	.....
Cuba City	83,375	87,225	172,200
Highland	.....	50,000	.....
Total	2,597,175	137,225	564,200
Year to date	21,575,205	1,389,250	6,483,430

Shipped during week to separating plants, 3,025,410 lb. zinc ore.

The report for the week ended Feb. 18 was delayed in the mails. For that week the base price for 60 per cent. zinc ore was $41@42.50; for 80 per cent. lead ore, $54@55. The shipments for the

week were 2,170,500 lb. zinc ore, 88,000 lb. lead ore and 319,300 lb. sulphur ore. Shipped to concentrating plants, 1,939,480 lb. zinc ore.

Joplin, Mo., Feb. 25—The highest price paid for zinc-sulphide ore was $46, the assay base ranging from $39 to $43 per ton of 60 per cent. zinc, except fines, which sold as low as $37 base. Zinc silicate sold at $20@23 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $39.80; the scale base was $41.77. Lead ore opened the week at $54, followed by offerings of $54.50, $55 and $55.50 per ton, with unconfirmed rumors of $56. The average price, all grades of lead, was $54.84, the bulk of the shipment selling at $55@55.50 per ton.

Purchasing agents were busy early this week loading out late purchases of zinc ore last week, and, although the base price was strong and higher buying was limited, offerings by producers were stronger than the purchases. A firm spelter market should keep zinc ore strong at present prices, and will, unless an effort is made by holders to unload a quantity upon the market. The stock in the bins is approximately 10,000 tons, the greater part of which has been and is being held by strong companies for the present level or higher prices. The offerings in excess of the purchases came from small holders.

SHIPMENTS, WEEK ENDED FEB. 25.

	Zinc lb.	Lead lb.	Value.
Webb City-Carterville	4,145,880	1,223,540	$116,562
Joplin	2,985,170	317,280	69,919
Galena	685,620	190,700	18,860
Duenweg	673,150	51,290	14,847
Oronogo	480,780	87,100	12,522
Alba-Neck	527,700	.....	11,609
Aurora	436,530	.....	7,246
Spring City	333,250	29,700	6,144
Carthage	296,540	.....	5,930
Miami	51,240	182,600	5,544
Sarcoxie	153,730	.....	3,074
Quapaw	125,780	7,320	2,586
Granby	120,110	20,560	2,080
Badger	82,540	.....	1,650
Carl Junction	54,310	.....	1,194
Cave Springs	57,670	.....	1,153
Stott City	52,380	.....	1,047
Jackson	51,190	.....	972
Totals	11,313,570	2,110,060	$282,939
2 months	75,463,130	14,173,050	$1,891,982

Zinc value, the week, $225,080; 2 mos., $1,498,741
Lead value, the week, 57,859; 2 mos., 393 241

MONTHLY AVERAGE PRICES.

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39 16	53.64	55.36
March	43.60	.....	39.71	.....	51.26	.....
April	41.00	.....	39.33	.....	49.72	.....
May	40.19	.....	37.51	.....	48.16	.....
June	40.20	.....	37.83	.....	48.80	.....
July	39.63	.....	36.80	.....	48.59	.....
August	40.13	.....	37.32	.....	49.75	.....
September	43.45	.....	39.96	.....	54.73	.....
October	43.31	.....	40.50	.....	53.18	.....
November	47 20	.....	43 20	.....	54 80	.....
December	42.50	.....	40 70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

CHEMICALS

New York, March 1—The general market continues quiet, but steady and without special incident.

Copper Sulphate—Business is moderate and prices unchanged at $4 per 100 lb. for carload lots, and $4.25 per 100 lb. for smaller parcels.

Arsenic—The market is still dull, with sales moderate. White arsenic can be had at $2 per 100 lb. for carload lots; up to $2.12½ per 100 lb. for small orders.

Nitrate of Soda—Business is increasing in volume, but prices remain unchanged, 2.10c. per lb. being quoted for both spot and future positions.

MINING STOCKS $

New York, March 1—At the beginning of the week, the decision of the Interstate Commerce Commission against allowing increases of railroad rates caused sharp declines in the active railroad stocks, and there were sympathetic falls in industrial stocks also. These recessions were gradually recovered, and sentiment became more optimistic. At the close prices are nearly up to those of a week ago, on a rather slow market.

On the Curb there was a similar reaction and recovery, while the market is rather sluggish at the close. The Cobalt stocks held their prices pretty well during the week, on fair dealings. Tonopah and Tonopah Extension were inclined to be strong. The copper stocks held fairly well, after a little break had occurred, and close about even for the week.

Trustees of the Great Northern Iron Ore properties have declared a dividend of 50c. per share, the same as in November, 1910. Previous dividends were 50c., declared in August, 1910, and February, 1910, and $1 in August, 1909, February, 1908, and August, 1907. The present dividend makes a total of $5 up to date.

Boston, Feb. 28—Features in this market have been a $30 drop in the price of Calumet & Hecla mining shares to $470, which is the lowest price since 1904 when a low of $435 was touched. At the same time strength was exhibited in Osceola and Superior mining shares, the former advancing $4 to $114 and the latter $1.37½ to $36.87½. The significance of this is that the proposed merger, it is believed, will not go through at the special meetings of the various companies March 7. This Calumet & Hecla merger promises to bring out some interesting developments; in fact some have already started and the plot thickens. Up to the present the only opposition has come from Ahmeek and Osceola stockholders. T. L. Chadbourne, of Michigan, heads the opposition in the case of the Ahmeek while Tucker, Hayes & Co., members of the local exchange have issued a circular in opposition to the consolidation plan as set forth.

The resignation of Superintendent Uren of the former Bigelow properties has also served to complicate matters

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
II, 1910	112,712,493	66,618,322	37,369,518
III	120,067,467	62,944,818	40,585,767
IV	117,477,639	67,985,951	31,332,434
V	123,242,476	59,305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	127,803,618	67,731,271	61,831,780
IX	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424 316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	.....	.....	.....

VISIBLE STOCKS.

	United States.	Europe.	Total.
III, 1910	107,187,992	254,150,400	361,338,392
IV	123,824,874	249,625,600	373,450,474
V	141,984,159	246,870,400	388,854,559
VI	160,425,973	239,142,400	399,568,373
VII	168,386,017	232,892,800	401,278,818
VIII	170,640,678	222,320,000	392,960,677
IX	168,881,245	218,444,800	387,326,045
X	148,793,714	211,276,800	360,070,514
XI	139,261,914	198,060,800	337,322,714
XII	130,389,069	193,200,000	323,589,069
I, 1911	122,030,195	187,797,120	309,827,315
II	142,439,490	186,368,000	328,807,490
III	.....	.....	.....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company.	November.	December.	January.
Anaconda	21,900,000	21,500,000	21,000,000
Arizona, Ltd	3,010,000	3,224,000	3,024,000
Balaklala	.....	160,000	932,452
Copper Queen	7,372,776	.....	7,298,227
Calumet & Ariz	1,930,000	1,900,000	2,044,000
Detroit	1,840,939	.....	2,017,397
East Butte	618,191	870,812	1,134,000
Imperial	*nil*	.....	.....
Mammoth	.....	.....	.....
Nevada Con	5,207,353	5,510,936	5,268,954
Old Dominion	2,754,000	2,287,000	2,095,000
Shannon	1,420,000	.....	1,250,000
Superior & Pitts	2,160,000	2,175,000	2,014,000
United Verde*	3,000,000	.....	3,000,000
Utah Copper Co	7,468,515	7,137,585	6,707,116
Lake Superior*	20,400,000	20,000,000	.....
Non-rep. mine*	13,200,000	13,100,000	.....
Total production.	92,281,775	.....	.....
Imports, bars, etc.	24,835,954	25,192,854	.....
Total blister	117,117,629	.....	.....
Imp. in ore & matte	5,542,279	9,316,091	.....
Total	122,660,608	.....	.....
Brit. Col. Cos.:			
British Col. Copper	917,994	.....	.....
Granby	1,410,261	1,645,613	.....
Mexican Cos.:			
Boleo	.....	2,766,630	2,647,173
Cananea	3 658 000	.....	.....
Moctezuma	1,654,235	.....	1,738,429

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

for he has now come out with a manifesto that the consolidation of the Osceola, Ahmeek, Seneca, Isle Royale and Tamarack with the Calumet would be a grave mistake. All in all it now looks as if the merger plan would not go through. Calumet people themselves say that it would be acceptable to form a holding company and increase the number of shares beyond the amount allowed by Michigan statutes.

Sentiment continues optimistic regarding copper shares although there is little response from the public.

The Curb has brought out no features during the week. The advent of Boston men on the board of directors of the Daly West Company is pleasing to holders in this community.

Assessments

Company.	Delinq.	Sale.	Amt.
Aeolian, Ida.	Mar. 1	Mar. 18	$0.005
Albion, Utah.	Feb. 23	Mar. 27	0.13
Capital, Ida.	Feb. 10	Mar. 10	0.002½
Cedar Creek, Ida.	Apr. 1	May 1	0.002
Eastern Star, Ida.	Mar. 4	Apr. 4	0.002
Emma, Utah.	Mar. 15	Apr. 10	0.005
Florence M. & M., Ida.	Feb. 20	Mar. 20	0.001
Grant, Ida.	Feb. 27	Mar. 27	0.003
Great Eastern, Ida.	Feb. 9	Mar. 9	0.003
Hancock Con., Mich.	May 1	.....	1.00
Helvetia Copper, Ariz.	Feb. 15	.....	0.50
Ida. Copper, Ida.	Mar. 10	Apr. 8	0.003
Independence, Utah.	Mar. 9	Mar. 25	0.007
Mineral Farm, Ida.	Mar. 9	Apr. 15	0.003
Missoula Copper, Ida.	Mar. 13	Apr. 5	0.005
Lower Mammoth, Utah.	Feb. 11	.....	0.05
Lucky Swede, Ida.	Apr. 1	May 1	0.002
Rexall, Utah.	Feb. 18	Mar. 20	0.005
Savanna, N. M.	Mar. 1	.....	0.50
Selma, Utah.	Feb. 15	Mar. 15	0.00½
Silver Crown, Ida.	Mar. 21	Apr. 21	0.001
Spokane Tunnel, Ida.	Feb. 18	Mar. 11	0.002
Sunrise, Ida.	Feb. 18	Mar. 11	0.003
Super'r & Boston Cop., Ariz.	Feb. 20	.....	1.00
Tonopah North Star, Nev.	.....	.....	0.03
Trans.-Continental, Ida.	Mar. 1	Apr. 1	0.002

Monthly Average Prices of Metals

SILVER

Month.	New York.			London.		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	.....	23.227	23.690	.....
April	51.428	53.221	.....	23.708	24.483	.....
May	52.905	53.870	.....	24.343	24.797	.....
June	52.538	53.462	.....	24.166	24.651	.....
July	51.043	54.150	.....	23.519	25.034	.....
August	51.125	52.912	.....	23.588	24.428	.....
September	51.440	53.295	.....	23.743	24.567	.....
October	50.923	55.490	.....	23.502	25.596	.....
November	50.703	55.635	.....	23.351	25.680	.....
December	52.226	54.428	.....	24.030	25.160	.....
Total	51.502	53.486	.....	23.706	24.670	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	New York.				London, Standard.	
	Electrolytic		Lake.			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	.....	13.586	.....	59.214	.....
April	12.733	.....	13.091	.....	57.238	.....
May	12.550	.....	12.885	.....	56.313	.....
June	12.404	.....	12.798	.....	55.310	.....
July	12.215	.....	12.570	.....	54.194	.....
August	12.490	.....	12.715	.....	55.733	.....
September	12.379	.....	12.668	.....	55.207	.....
October	12.553	.....	12.788	.....	56.722	.....
November	12.742	.....	12.914	.....	57.634	.....
December	12.581	.....	12.863	.....	56.769	.....
Year	12.738	.....	13.039	.....	57.054	.....

TIN AT NEW YORK

Month.	1910.	1911.	Month.	1910.	1911.
January	32.700	41.255	July	32.695	.....
February	32.920	41.614	August	33.972	.....
March	32.463	.....	September	34.982	.....
April	32.976	.....	October	36.190	.....
May	33.125	.....	November	36.547	.....
June	32.769	.....	December	38.199	.....
			Av. Year	34.123	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	.....	4.307	.....	13.063	.....
April	4.376	.....	4.225	.....	12.641	.....
May	4.315	.....	4.164	.....	12.550	.....
June	4.343	.....	4.207	.....	12.688	.....
July	4.404	.....	4.291	.....	12.531	.....
August	4.400	.....	4.290	.....	12.513	.....
September	4.400	.....	4.289	.....	12.582	.....
October	4.400	.....	4.271	.....	13.091	.....
November	4.442	.....	4.314	.....	13.217	.....
December	4.500	.....	4.363	.....	13.197	.....
Year	4.446	.....	4.312	.....	12.920	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	.....	5.487	.....	23.031	.....
April	5.439	.....	5.289	.....	22.469	.....
May	5.191	.....	5.041	.....	22.100	.....
June	5.128	.....	4.978	.....	22.094	.....
July	5.152	.....	5.002	.....	22.406	.....
August	5.279	.....	5.129	.....	22.800	.....
September	5.514	.....	5.364	.....	23.165	.....
October	5.628	.....	5.478	.....	23.900	.....
November	5.976	.....	5.826	.....	24.083	.....
December	5.624	.....	5.474	.....	24.019	.....
Year	5.520	.....	5.370	.....	23.050	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.56	17.38	14.81
March	18.53	.....	16.93	.....	17.00	.....
April	18.28	.....	16.84	.....	16.75	.....
May	17.10	.....	15.94	.....	16.18	.....
June	16.52	.....	15.60	.....	15.53	.....
July	16.40	.....	15.40	.....	15.40	.....
August	16.09	.....	14.89	.....	15.16	.....
September	15.92	.....	14.73	.....	14.93	.....
October	15.90	.....	14.05	.....	14.88	.....
November	15.84	.....	14.26	.....	14.78	.....
December	15.90	.....	14.15	.....	14.65	.....
Year	$17.10	.....	$15.65	.....	$15.83	.....

STOCK QUOTATIONS

COLO. SPRINGS Feb. 28

Name of Comp.	Bid.
Acacia	.03
Cripple Cr'k Con.	.01½
C. K. & N.	.14
Doctor Jack Pot	.06½
Elkton Con.	.68
El Paso	.72
Findlay	.06½
Gold Dollar	.13
Gold Sovereign	.02
Isabella	.16
Jack Pot	.06
Jennie Semple	.10
Lexington	.01½
Moon Anchor	.03
Old Gold	.03
Mary McKinney	.44
Pharmacist	.02
Portland	1.03
Vindicator	.89
Work	‡.03½

SALT LAKE Feb. 28

Name of Comp.	Bid.
Beck Tunnel	.26
Black Jack	.13½
Carisa	.20
Cedar Talisman	.10
Colorado Mining	.55
Columbus Con.	.13
Daly Judge	4.55
Grand Central	1.32½
Iron Blossom	1.27½
Little Bell	.50
Lower Mammoth	.13
Mason Valley	9.00
May Day	.19½
Nevada Hills	2.72½
New York	.15½
Prince Con	.65
Silver King Coal'n	1.75
Sioux Con.	.39
Uncle Sam	.70
Yankee	.14

SAN FRANCISCO. Feb. 28.

Name of Comp.	Clg.	Name of Comp.	Bid.
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	‡.05	Belmont	5.97½
Belcher	.57	Jim Butler	.27
Best & Belcher	.28	MacNamara	.15
Caledonia	.30	Midway	.13
Challenge Con.	.09	Mont.-Tonopah	.91
Chollar	.14	North Star	.05
Confidence	.45	West End Con.	.55
Con. Virginia	1.10	Atlanta	.13
Crown Point	.60	Booth	.07
Gould & Curry	.14	C.O.D. Con.	.11
Hale & Norcross	.18	Comb. Frac.	.14
Mexican	1.65	Jumbo Extension	.37
Occidental	.45	Oro	.03
Ophir	1.15	Silver Pick	.05
Overman	.28	St. Ives	‡.05
Potosi	.25	Tramps Con.	.03
Savage	.16	Argonaut	1.60
Sierra Nevada	.23	Bunker Hill	‡6.50
Union Con.	.48	Cent. Eureka	1.40
Yellow Jacket	.31	So. Eureka	6.50

N. Y. EXCH. Feb. 28

Name of Comp.	Clg.
Amalgamated	63⅜
Am. Agri. Chem.	58⅞
Am.Sm.&Ref.,com	77⅜
Am. Sm. & Ref., pf.	105¼
Anaconda	38¼
Batopilas Min.	2⅛
BethlehemSteel pf	62
Federal M. & S., pf	63½
Goldfield Con.	6⅞
Great Nor., ore ctf.	60
Homestake	86
Nat'nalLead,com.	56
National Lead, pf.	107¾
Nev. Consol.	19
Pittsburg Coal,pf.	70¼
RepublicI&S,com.	33
Republic I & S, pf.	99
SlossSheffi'd,com.	53¼
Sloss Sheffield, pf.	110¾
Tennessee Copper	38⅝
Utah Copper	45¼
U. S. Steel, com.	78½
U. S. Steel, pf.	118¾
Va. Car. Chem.	69⅞

N. Y. CURB Feb. 28

Name of Comp.	Clg.
Ariz.-Cananea	‡3⅜
Barnes King	‡⅝
Braden Copper	¼
B. C. Copper	6⅛
Buffalo Mines	2.15
Butte Coalition	18
Caledonia	‡1 1/16
Calumet & Mont.	‡.10
Chino	21¾
Cobalt Central	.09½
Con. Ariz. Sm.	1¼
Davis-Daly	1¾
Ely Con.	.28
El Rayo	‡2⅛
Florence	2⅜
Giroux	6 7/16
Greene Cananea	6 1/16
Greenwater	.05½
Guanajuato	3⅜
Guerrero	‡1⅛
Guggen. Exp.	210
Inspiration	8
Internat. S. & R.	131
Kerr Lake	7
La Rose	4⅞
McKinley-Dar-Sa.	1⅛
Miami Copper	19⅝
Mines Co. of Am.	5⅞
Mont. Shoshone	‡.10
Nev. Utah M. & S.	1 1/16
Nipissing Mines	11
Ohio Copper	1¾
Pacific Sm. & M.	¼
Precious Metals	1⅜
Ray Central	1 9/16
Ray Con.	18
Red Warrior	1⅛
South Utah M. & S.	1/16
Standard Oil	625
Stewart	.75
Tonopah	8⅛
Tonopah Ex.	1.33
Tri-Bullion	½
Tularosa	⅛
Union Mines	1/16
Yukon Gold	4

LONDON Mar. 1

Name of Com.	Clg.
Camp Bird	£1 12s 6d
Dolores	1 10 0
El Oro	1 5 0
Esperanza	1 14 1½
Mexico Mines	7 3 9
Oroville	0 7 6
Stratton's Ind.	0 2 0
Tomboy	0 15 0

BOSTON EXCH. Feb. 28

Name of Comp.	Clg.
Adventure	5¼
Algomah	8
Allouez	34
Am. Zinc	24⅛
Arcadian	‡3
Arizona Com.	15¼
Atlantic	4
Bonanza	.50
Boston & Corbin	.12⅝
Butte & Balak	6⅛
Calumet & Ariz.	51½
Calumet & Hecla	478
Centennial	12
Con. Mercur	.05
Copper Range	66¼
Daly-West	3½
East Butte	12¾
Franklin	10
Granby	35⅛
Hancock	23¼
Helvetia	1 13/16
Indiana	12¾
Isle Royale	13⅞
Keweenaw	2⅛
Lake	37
La Salle	4¾
Mass	7
Michigan	3
Mohawk	44
New Arcadian	31⅝
North Butte	29
North Lake	6½
Ojibway	6½
Old Dominion	39
Osceola	112
Parrot	12
Quincy	67
Shannon	11
Shattuck-Ariz.	20
Superior	37¼
Superior & Bost.	5
Superior & Pitts.	14¾
Tamarack	43
Trinity	4½
U. S. Smelting	35¾
U. S. Smelt'g, pf.	47¾
Utah Apex	2⅛
Utah Con.	13½
Victoria	1¾
Winona	8¼
Wolverine	120
Wyandot	1¼

BOSTON CURB Feb. 28

Name of Comp.	Last.
Ahmeek	170
Bingham Mines	‡2.75
Boston Ely	.92½
Boswyocolo	‡.07½
Cactus	.19
Calaveras	1.97
Champion	.02
Chief Cons	1.37½
Corbin	3.25
Cortez	2.50
Crown Reserve	2⅜
First Nat. Cop.	2.18½
Live Oak	.18
Mackinaw	.10
Majestic	.36
Nat'l Mine & Ex.	‡.03
Nevada-Douglas	2 12½
Oneco	1.62½
Raven Copper	.33
Rhode Island Coal	5.12½
San Antonio	‡5
South Lake	6.12½
Trethewey	‡1½
Tuolumne Copper	4½
United Zinc, pfd.	5
Vulture	7½
Yuma	‡22½

‡Last quotation.

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GOLD AND SILVER

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14,816 — PUMPS — Humphrey Pumps and Compressors. H. A. Humphrey. (Engineering, Nov. 18, 1910; 4⅓ pp. illus.) Paper before Manchester Assn. of Engineers. 40c.

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CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—		
Carbons, good drill quality, carat		$50.00@75.00
Carborundum, f.o.b. Niagara Falls, powd.	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05¾@.06
Emery, in kegs; Turkish flour	"	.01¾@.02
Grains	"	.03½@.04
Naxos flour	"	.01¾@.02
Grains	"	.03½@.04
Chester flour	"	.01½@.02
Grains	"	.03½@.04
Peekskill flour, f.o.b. Easton, Pa.	"	.01½@.01¾
Grains, in kegs	"	.02¾@.03
Garnet, per quality	sh. ton.	25.00@35.00
Pumice Stone, Am. Powd., 100 lb.		1.60@2.00
Italian, powdered	per lb.	.01¾@.01¾
Lump, per quality	"	.03½@.30
Rottenstone, ground	"	.02@.04
Lump, per quality	"	.05@.20
Rogue, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07@.07½
ACIDS—		
Acetic 28%	lb.	.0165@.0205
Boric	"	.07
Hydrofluoric, 30%	"	.02¾@.03½
" 48%	"	.06
" 52%	"	.06½
" 60%	"	.10
Hydrochloric acid, 20° per 100 lb.		1.25@1.50
Nitric acid, 36° to 40°	per lb.	.03½@.04½
Sulphuric acid, 50°, bulk per ton.		$12 up
60°, 100 lb. in carboys.		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys.		1.00@1.10
66°, bulk, ton		18.00
Oxalic	per lb.	.07@.07½
ALCOHOL—Grain 95%	gal.	2.54@2.56
Denatured	"	.42
Refined wood, 95@97%	"	.52@.57
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	"	.04½@.05
ALUMINUM—Sulphate, com'l.	lb.	.90@2.00
AMMONIA—24 deg. lb.	"	.04½@.05½
" 26 deg. lb.	"	.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.32
Carbonate	"	.08@.08¾
Muriate grain	"	.05½@.06
Lump	"	.09½@.09½
Sulphate, 100 lb.	"	2.85@2.90
Sulpho-cyanide com.	"	.25
" " chem. pure	"	.35
ANTIMONY—needle, powder.	lb.	.04½@.05
Oxide	"	.07¾@.08
ARSENIC—white	"	.02@.02½
Red, Outside brands	"	.05¾@.06½
Saxony	"	.06¼@.06¾
ASPHALTUM—		
Barbadoes	per ton.	80.00@100.00
West Indies	"	30.00@60.00
Egyptian	lb.	.30
Gilsonite, Utah ordinary	per ton.	36.00@60.00
Trinidad	"	20.00@30.00
California	per ton.	23.00@28.00
BARIUM—		
Carb. Lump. 80@90%	lg. ton.	26.00@35.00
Precipitated, 96@98%	"	31.00@33.00
Powdered, natural	lb.	.02@.02¼
Chloride com'l	ton.	34.00@37.00
Nitrate powdered, in casks	lb.	.04½@.05¾
Blanc Fixe, dry, bbl.	per lb.	.02¾@.04
BARYTES—		
Am. Ground	sh. ton.	10.00@13.00
Floated	"	16.00@17.00
Foreign floated	"	18.50@22.50
BLEACHING POWDER—35% 100 lb.		1.25@1.40
BLUE VITRIOL—(copper sulphate), carload, per 100 lb.		4.00@4.25
BONE ASH	lb.	.02¾@.04
BORAX, sacks	"	.03½@.04
CALCIUM Acetate, gray, 100 lb.		2.00@2.05
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65.00
Chloride, f.o.b. N. Y.	"	11.00@14.10
CEMENT—Slag cement	bbl.	.75@1.25
Portland, Am. 400 lb	"	1.20@1.30
Foreign	"	2.25@2.90
"Rosendale," 300 lb.	"	.85
(in sacks)	"	.65
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton.	14.00@16.00
Bricks, f.o.b. Pittsburg, per M.		175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	ton.	8.00@9.00
Foreign	"	11.50@18.00
COBALT—Oxide	lb.	.80@.85
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.85
In bags	"	.60@.80
CRYOLITE (carload)	lb.	.06½@.07
FELDSPAR—Ground	sh. ton.	6.00@14.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis	"	16.00
Extra	"	20.00@23.00
Special extra	"	30.00@35.00
FIRE CLAY—F.o.b. St. Louis.		
St. Louis, extra quality	per ton.	5.00
" ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. Pittsburg:		
Lump	ton.	8.00@10.00
Ground	"	12.00@14.00
Foreign crude ex. dock	"	8.50
FULLER'S EARTH—Lump, 100 lb.		.80@.85
Powdered	"	.80@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.02@.04
Dust	"	.02½@.05
Chip	"	.04@.08
Lump	"	.05½@.12
Large lump	"	.08¼@.10½
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	"	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. Best	lb.	.01¾@.02½
German	"	.02½@.02¾
LEAD—Acetate (sugar of) brown,	lb.	.07¾@.09½
Nitrate, com'l	"	.08¾
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	7.50@8.50
Calcined, powdered	sh. ton.	26.00@37.00
Brick, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1.25
Sulphate (Epsom salt)	100 lb.	.90@1.00
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.006@.01
75@85% binoxide	"	.011@.015
85@90% binoxide	"	.01½@.04
90@95% binoxide	"	.06½@.08½
Ore, 80%-85%	sh. ton.	12.00@25.00
MARBLE—Flour	sh. ton.	9.00@9.50
MINERAL WOOL—		
Slag, ordinary	sh. ton.	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, normal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.10½@.11
Sulphate, double	"	.05½@.08
NITRATE OF SODA—		
100 lb. 95% (spot)		2.10
95% (future)		2.10
96% is 2½@7½c. higher per 100 lb.		
OZOKERITE—best	lb.	.12@.16
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.05¾@.06½
English glassmakers'	"	.08¼@.09½
Lithophone	"	.03½@.04
Metallic, brown	sh. ton	16.50@30.00
Red	"	14.00@18.00
Ocher, Am. common	"	10.00@15.00
Best	"	12.00@15.00
Dutch, washed	lb.	.02¾@.03
French, washed	"	.01¼@.02
Paris green, pure, bulk	"	.17½@.20½
Red lead, American	"	.06½@.07½
Foreign	"	.08¼@.09½
Turpentine, spirits bbl., per gal.		.87½@.91
White lead, Am., dry	lb.	.05½@.06
American, in oil	"	.07½@.07½
Foreign, in oil	"	.09@.09¾
Zinc white, Am. extra dry	"	.05¾@.06½
French, proc's, red seal, dry	"	.08¼@.08½
French, process, green seal, dry	"	.10½@.10½
PHOSPHATES—Acid		.55@60c. per unit
*Fla., hard rock 77%		3.50@6.00
land pebble 68%		3.60@3.75
†Tenn., 78@80%		5.00@5.50
75%		4.75@5.00
68@72%		4.25@4.50
‡So. Car. land rock 60%		3.50@3.75

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

POTASSIUM—		
Bicarbonate crystal	lb.	$.07½@.08
Powdered or granulated	"	.08@.08¼
Bichromate, Am.	"	.07¾@.08
Scotch	"	.10¼
Bromide	"	.20
Carbonate (80@85%)	"	.03½@.04½
Caustic, ordinary	"	.03¾@.05¾
Elect. (90% KOH)	"	.05½@.06
Chloride (muriate), 100 lb.		1.90
Chlorate, powdered	"	.08½@.09½
Crystals	"	.09@.09¼
Cyanide (98@99%)		
Carloads (30,000 lb.)	"	18c.
5-ton lots		18½c.
Less than 5 tons		.19
Kainite, long ton, bulk, 7.50; bags,		8.50
Permanganate	lb.	.09½@.10½
Prussiate, yellow	"	.13@.13¾
Red	"	.26@.30
Sulphate (basis 90%)	100 lb.	2.18@2.21
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. R. I.	per unit.	11½@12
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10¾@11
Imported, non-arsenical, furnace size, ex-ship, per unit		.13
Imported, arsenical, furnace size, ex-ship, per unit		.12½@.12¾
Imported fines, arsenical, ex-ship, per unit		.09½@.10
Imported fines, non-arsenical, ex-ship, per unit		.10½@11

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

SALT—N. Y. com. fine 280 lb. bbl.		.72@1.13
N. Y. agricultural	sh. ton.	3.80@4.50
SALTPETER—Crude	100 lb.	4.00@4.50
Refined, crystals	"	5.00@5.75
SILICA—		
Ground quartz, ord'ry.	lg. ton	7.00@15.00
Silex, ground	"	7.00@15.00
Silex, floated	"	35.00@40.00
Lump quartz	"	5.00@5.50
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.33½@.36¾
SODIUM—Acetate	lb	.04¼@.05
"Alkali," per 100 lb., 58/48		.90@.95
Bicarb. soda, per 100 lb		1.00@1.30
Soda, caustic, per 100 lb., 78/60		1.80@2.00
Soda, caustic, powdered		.02½@.03
Salt cake, per 100 lb., bulk		.50@.60
Salt cake, bbl		.67½@.80
Soda, monohydrate, per lb.		1.30@1.75
Bichromate	lb.	.05¼@.06¼
Bromide	"	.20
Chlorate, com'l	"	.08¼@.09½
Cyanide, 120-130% KCN, per 100%		
Carloads (30,000 lb.)	lb.	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	.20
Hyposulphite, Am.	"	1.30@1.50
Phosphate	100 lb.	2.10@2.40
Prussiate	"	.08@.08¾
Sal soda, f.o.b. N. Y.	"	.60@.75
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	"	.65@1.00
Sulphate, com'l (Glauber's salt)	100 lb.	.60@.80
Sulphate, com'l, calcined		.65@.85
STRONTIUM—Nitrate	lb.	.07@.08
SULPHUR—Louisiana (prime) to New York	lg. ton.	22.00 up
To Boston, Philadelphia or Baltimore	"	22.50 up
Roll	100 lb.	1.85@2.15
Flour	"	2.00@2.40
Flowers, sublimed	"	2.20@2.60
Powdered commercial, bags		1.55
Sicilian, extra qual., unmixed seconds, crude brimstone to New York	lg. ton.	$22.00
TERRA ALBA—Fr. & Eng.	100 lb.	.75@1.00
TALC—Domestic	sh. ton.	12.00@20.00
French	"	33.00@45.00
Italian, best	"	45.00@50.00
TIN—Bi-chloride, 50°	lb.	.12½
Crystals	"	.27½
Oxide, lb.	"	.45
URANIUM—Oxide	"	2.20@4.25
ZINC—Chloride sol., com. 20°	"	.02¼
Chloride, granular	"	.04@.04½
Dust	"	.06¾@.07
Sulphate	"	.02@.02½

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output as a matter of private contract.